AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 24 NEW YORK AND LONDON NUMBER 44

Published at 218 William St., New York, every Thursday by the

American Machinist Press.

[INCORPORATED.]

Also published at 34 Norfolk St., Strand, London, W. C.

Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Address all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price:

$4 per year, postage prepaid, to any post office in the world. No back numbers beyond current year. For sale by newsdealers, generally.

Subscription agent for Denmark, Norway and Sweden, V. Lowener, Copenhagen. Subscription agent for Germany, Austria and Holland, Gustav Diechmann & Sohn, Neue Promenade 4, Berlin. Subscription agent for Spain, J. F. Villalta, Puertaferrisa, 7-9 Barcelona.

Entered at New York P. O. as mail matter of the second class.

Cable address, "MACHINIST," N. Y. Lieber's and A B C Codes.

Reciprocity—An Untrue Illustration

In the course of an editorial on "Reciprocity," with most of which we are in substantial agreement, "The Engineer" uses a supposititious illustration as follows:

"The position in the United States is very peculiar. Production, fostered by an astounding tariff, has apparently overtaken home demand. The system of two prices is being adopted. Roughly speaking, the duty on imported machine tools is 40 per cent. *ad valorem*. The American maker sells a lathe to an American customer for £280. He sells the same lathe in this country for £200. The lathe costs the maker, say, £200. He is well content to clear £80 on the two. We need not stop to explain the advantage which the possession of a second market gives the manufacturer. The English trade represents a species of equalizer or flywheel to steady his production. When the home trade falls off a little, he does not shut up his shops or discharge his men. He sells elsewhere at cost price or a little under. He can afford to take less than cost price for a large percentage of his goods. There is sound reason to believe that at the present moment the American manufacturer is making little, if any, profit on his export trade. Enormous profits on the home trade suffice to recoup him."

It has been proven that some American manufacturers do sell their products abroad at lower prices than they sell them for at home, and our contemporary would have done better, it seems to us, to have taken some such line of goods as an illustration, instead of singling out machine tools which, save in some exceptional case possibly, have not been sold abroad at lower prices than those ruling in America, but on the contrary have often, and in very many cases, been sold at higher prices abroad than at home. Indeed it is now the complaint of foreign representatives of American machine-tool builders that the latter are too stiff in their prices on machine tools for export. If "The Engineer" will examine into the matter a little it will find the competition among American machine-tool builders for both home and foreign trade is very keen and that American machine tools are, generally speaking, sold both at home and abroad on very close margins of profit—margins, we dare say, not generally greater than those realized on British machine tools. No such methods as those given by "The Engineer" are pursued by the American machine-tool builders. On the contrary, as we have previously pointed out, the American machine-tool builder is the victim of a system under which a large share of the material used by him has to be purchased at prices considerably higher than those at which the same American material is offered to his foreign competitors.

"The American Danger."

A fresh outbreak against what is called the "American danger" has sprung up in Germany and Austria, and some very absurd things are being said about the methods of American business men and of the United States Government. For instance, it has been asserted that the United States Government maintains detectives in Germany for the purpose of discovering trade secrets, and one man cited a case of a factory in Saxony which had been ruined thereby.

Now, the man who made this statement may sincerely think that the United States Government does that sort of thing, but we believe that if he were in America a little while he would be slow to believe that the United States Government does or would do any such thing. The fact is that our government does far less for the interests of American manufacturers in foreign countries than it might do with propriety and entire fairness to all, and we feel quite sure that it does not pay a single cent to maintain a force of detectives in foreign countries to find out things for the benefit of American manufacturers. The simple fact is that by the development of our methods of manufacture and the free use of machinery we have arrived at a stage at which we can manufacture a great many things better and more cheaply than they can be made elsewhere. The inundation of these things is not an inundation similar to that which would be produced by the breaking of a dam and which is going to drown or otherwise exterminate a lot of people in foreign countries. It simply means that they will be able to obtain certain things of better quality and at lower prices than they would otherwise be able to obtain them, and the presumption is that this will make living conditions better for them after the inevitable readjustment of trade conditions has been effected, which follows the introduction of labor-saving machinery or any other means of reducing costs of desirable things.

The Naval Engineers at Santiago.

Editor American Machinist:

I wish to congratulate you on the admirable article in your issue No. 43 entitled "Some Santiago Naval History" and on the clear presentation of facts therein. There are just two points, however, which I would like to correct: one, that the "Oregon" was the only ship that had steam on all her boilers, as the "Texas" had steam on all hers, though it is quite probable that she was not in the same state of preparedness that the "Oregon" was.

The other point is that in which you say that "Captain Clark has always been ready to credit Milligan with his share of the work." I do not wish to detract in any way from the credit that is due Captain Clark, but I must protest against his being accorded the manliness of having ever, except in private conversation, given Milligan any more credit for the work the "Oregon" did than he gave the least responsible officer in the ship. His official report made after the battle of July 3 makes no special mention of the distinguished work of Milligan, though it was current rumor that Clark fairly embraced him on the deck of the "Oregon" after the "Colon" surrendered. But what does his official report say? Here it is:

"While I cannot mention the name of each officer and man individually, I am going to append a list of the officers, with

the stations that they occupied, hoping that it may be of service to them should the claims of others for advancement above them ever be considered." (Observe, *not* that any of them were deserving of advancement.

Then follows a list of the officers, and near the bottom is: "R. W. Milligan, chief engineer; in charge of machinery." And that is all, so far as I have been able to ascertain, that Captain Clark has ever placed on record about Milligan. A greater piece of moral cowardice would be hard to conceive!

While his immediate commanding officer did not appear to think that Milligan's service was deserving of special commendation, Admiral Sampson took a different view of the matter, and to him is due the credit of having officially recognized the valuable service that Milligan rendered. This was done in a letter from Guantanamo Bay dated July 22, 1898, the text of which follows:

"I desire to recommend Robert W. Milligan, chief engineer of the U. S. S. 'Oregon,' to you for some substantial recognition of efficient service on board that ship. . . . In the recent battle on the 3d of July off Santiago the performance of this vessel was conspicuously excellent from the start to the finish, and it is the opinion of those who have had the best opportunities to judge that this excellent result, as far as her motive power is concerned, was due to the untiring energy and intelligent efforts of her chief engineer in the performance of his duty.

"Excellence in this respect, I think, should be rewarded in a manner that will make this officer conspicuous above others who have had equally good opportunities.

"I, therefore, respectfully recommend that he be advanced at least five numbers on the list of chief engineers."

Three days before the date of this letter Secretary Long had addressed a letter to Admiral Sampson asking whether some of the engineer officers of the fleet were not deserving of special consideration. This letter, of course, was not received until some time after Admiral Sampson had forwarded the above letter recommending Milligan for advancement. In reply to this letter of Secretary Long, Sampson wrote under date of August 6 as follows:

"My dear Mr. Secretary: I have just received your letter of July 19 with regard to the recommendation for promotion.

"Ere this time you will have received my letter of the 22d of July containing my recommendation in the case of Chief Engineer Milligan of the battleship 'Oregon.' If this recommendation meets with your approval, and covers the case which you at that time had in mind, it would give me pleasure.

"There are perhaps four chief engineers who were in the fight of July 3 who are worthy of commendation, and whose ships were in good condition; but I think that there is a great difference between their cases and that of Chief Engineer Milligan."

These are the official records, and you will see that Captain Clark is not on record as having given Milligan his share of the credit. But he was not the only commanding officer who practically ignored the engineer officers in his official report; for, in his report of the battle, the captain of the "Brooklyn" did not even mention the name of one, although he mentioned almost every other officer in the ship. Naturally, this called particular attention to the matter, and upon the remonstrance of one of the engineer officers, the captain filed a supplementary report in which he gave credit to some of them for the work they did.

I trust, Mr. Editor, that I have not trespassed too much on your space, and that the importance of giving credit where it is due may prove sufficient justification.

AN ENGINEER.

The Consular Service and the Export Trade.

Editor American Machinist:

Permit me to call the attention of your readers to a subject of considerable interest to them, but which might escape receiving due consideration if not brought to their timely notice. In a few weeks Congress will reassemble, and among the many subjects to come up for consideration is a bill for the reorganization of the Consular service, introduced last year but not acted upon. No class has a more direct interest in the betterment of the Consular service than those engaged in foreign trade, and foremost among these are the exporters of American machinery. While no one expects Consuls to sell goods or obtain orders for American manufacturers, or do the work which every successful merchant must do for himself, it is well understood that valuable assistance has been rendered to our foreign trade by those of our Consuls who are fully alert and alive to the conditions surrounding them. By raising the entire Consular service to the highest degree of efficiency, the efforts of exporters to introduce American goods abroad will be greatly facilitated and reinforced.

It is generally conceded that however faulty our Consular system may be, the commercial reports which have been written by our Consuls and published by the State Department, are more timely and practical than anything produced by the Consular service of foreign countries. This good work, for which recognition is due, is performed by a small number of the more active and capable men in the service. The great majority of our Consuls are not adapted for this class of work either by nature or previous training. Selected in the manner in which they now are, perhaps not more than one out of four of the men appointed to the Consular service are capable of doing work that is really useful to our foreign trade. Many others develop into usefulness if allowed to remain at their posts a sufficient length of time. Hence arises the importance of retaining in the service really good men when once found. It will not do to leave this matter to the politicians, for they simply regard Consular offices as party spoils. The export trade has a proper and legitimate interest in seeing to it that none but good men are appointed and that after having shown their fitness, they be retained during good behavior.

A conspicuous instance of the politician's way of dealing with the Consular service may be recalled. A few years ago we had a Consul in one of the principal manufacturing cities in England, who by his valuable Consular reports and his untiring efforts on behalf of American manufacturers had achieved a great success and was highly esteemed both in this country and in England. When a change of administration took place, prominent business men and exporters in this country, irrespective of party, petitioned for his retention in office, as was also done by the Chambers of Commerce and other representative bodies within his Consular district in England. But the politicians demanded the place for party purposes. Their wishes prevailed and an untried country politician was sent to replace him. The latter has now been at his post some four years, and if he has ever done a thing of the slightest value to the American people, the fact has not become known.

Quite recently the Consul General at Cape Town resigned his office and came home because he found that he could not live on the salary paid to him by the United States. He was a practical man of business who had held the office for several years, during which time he was indefatigable in his work on behalf of American commercial interests, and to his efforts may be ascribed not a small part of the phenomenal growth of our trade in South Africa. For this work he was paid less than various small European countries pay their representatives at Cape Town. His resignation was a distinct loss to all persons doing business with that country.

The moment is unusually opportune for securing some thorough-going reorganization of the Consular service. The President is believed to be in sympathy with the movement. Those interested in the export trade can do themselves no greater service than by personally enlisting the assistance of their member of Congress in support of the bill now pending in Congress known as the "Burton Bill." While this bill does not cure all the faults and defects in our present system, it does cover the principal objects sought for, to wit.:

1. Careful scrutiny of appointees, making the appointments probationary at first and permanent only after a trial.

2. Tenure of office during good behavior with promotion for meritorious services.

3. Equitable readjustment of salaries on a basis sufficient to attract and hold men of the ability necessary to discharge the duties of the office.

CARL A. HANSMANN.

New York.

Commercial Review.

NEW YORK, Monday, October 28.

MACHINE TOOLS, ELECTRICAL MACHINERY, ETC.

It is an open secret that the Western tool-making shops are flooded with orders. One of them has so far exceeded the capacity of its own shops that it is having 300 or more lathes built outside by contract. Several manufacturers have recently raised the prices of radial drills of the smaller sizes by an amount roughly estimated at 5 per cent. It is commented that radial drills, large as well as small, are selling at present in a way to indicate especial popularity in this form of tool.

Reports among the New York city machine-tool selling houses indicate a heavy demand. A radical improvement in the past week is mentioned by one of the best authorities.

Engine and dynamo builders are finding an exceptionally large amount of business just now in the line of isolated plants for buildings in New York city.

The somewhat doubtful event of a successful issue to the plan for forming a $100,000,000 hardware dealers' trust would be one of material interest to the manufacturers of machinists' supplies. It is understood that the prominent New York firms are not in it. The consolidation of a trade covering 75,000 different articles would be a feat indeed.

Owing to the rapidly advancing price of belting butts, the executive committee of the Leather Belting Manufacturers' Association called a special meeting for November 12 to take such action in regard to changes in the price of belting as may be deemed necessary. An advance of some 15 per cent. in the price is not improbable.

The American Woodworking Machinery Company, which had a capital of $4,500,000 and $2,000,000 bonds, has been reorganized. The new company has been formed on a smaller capital.

The Sharon (Pa.) Steel Company has awarded the contract to the Brown & Zortman Machinery Company, of Pittsburgh, for the pipe mill and machine shop equipment to cost $56,000.

Kearney & Trecker, manufacturers of milling machines, Milwaukee, Wis., are running their factory night and day at their full capacity to meet demands.

The additions to the Carnegie Steel Company armor-plate mills, plans for which are being prepared, will cost something like $4,000,000 and will almost duplicate the present plant. The machinery equipment, which will form an important job for some of the larger machinery builders, will include a 12,000-ton hydraulic forging press, which it is rumored will cost $1,000,000, although this amount seems rather excessive.

The Westinghouse Electric & Manufacturing Company's foundry in Cleveland, O., will be dismantled when the new one at the selected site, Stewart Station, Pa., which is to be built in conformity with the company's foundry centralization scheme is ready. The machinery in the Cleveland foundry has therefore been offered for sale. It is understood that the foundry of the Westinghouse Machine Company at the new site will be erected before that of the Electric Company.

The Westinghouse Electric & Manufacturing Company will construct a plant in St. Petersburg. The New York Air-Brake Company is said to be considering the erection of one in Germany.

MACHINERY, MACHINES, AND PARTS OF—	AUGUST— 1900 Number.	AUGUST— 1900 Dollars.	AUGUST— 1901 Number.	AUGUST— 1901 Dollars.	EIGHT MONTHS ENDING AUGUST— 1899 Number.	1899 Dollars.	1900 Number.	1900 Dollars.	1901 Number.	1901 Dollars.
Cash Registers	1,126	78,990	1,491	128 016	.....	126,035	.....	514,501	7,078	589,466
Electrical	.....	550,146	.....	457,375	.....	1,828,048	.....	3,596,419	.....	3,919,574
Laundry Machinery	.....	39,575	.....	34,514	.....	60,686	.....	345,768	.....	337,249
Metal-working	.....	473,489	.....	160,849	.....	4,495,665	.....	4,712,225	.....	1,912,397
Printing Presses, and parts of	.....	163,924	.....	62,766	.....	597,894	.....	885,596	.....	468,001
Pumps and Pumping Machinery	.....	196,931	.....	168,586	.....	2,051,199	.....	1,976,527	.....	1,295,146
Sewing Machines, and parts of	.....	416,549	.....	315,033	.....	2,576,187	.....	3,095,892	.....	2,528,122
Shoe Machinery	.....	94,115	.....	93,895	.....	605,457	.....	780,065	.....	740,777
Steam Engines, and parts of—										
Fire	.....	.....	1	580	3	13,713	4	7,380	5	6,105
Locomotive	16	168,994	43	410,339	363	3,636,702	329	3,481,407	333	3,050,246
Stationary	99	51,645	103	53,401	549	304,107	900	525,596	865	507,696
Boilers and parts of Engines	.....	207,110	.....	136,267	.....	907,136	.....	1,223,392	.....	903,743
Typewriting Machines, and parts of	.....	216,616	.....	198,333	.....	1,890,038	.....	1,820,907	.....	1,905,633
All other Machinery, and parts of	.....	1,844,640	.....	1,710,379	.....	12,796,910	.....	15,694,889	.....	12,063,165

UNITED STATES EXPORTS OF MACHINERY OF DOMESTIC MANUFACTURE, INCLUDING AUG. 1901.

Still another plant for the manufacture of large Corliss engines is being established in the West. It is that of the Fisher Machine Works, who have already bought tools for a shop for this purpose in Leavenworth, Kan.

The Structural Iron and Steel Company, of Baltimore City, Ind., has been awarded contracts for erecting a machine shop at Porto Rico for the Juanica Centiale Railway.

Bids will be received up to November 18th by the Cuero Cotton Mill, Cuero, De Witt County, Texas, for a complete equipment of machinery, tools, etc., on a basis of 5,000 spindles and 160 looms. The mill reserves all rights. Specifications can be had on application.

The National-Acme Manufacturing Company has been incorporated under the laws of Ohio, with $750,000 capital, and has bought out the Acme Machine Screw Company, of Hartford, Conn., and the National Manufacturing Company of Cleveland, Ohio. It assumes their contracts and obligations. The company has purchased a site on the Pennsylvania Railroad at Stanton street, Cleveland, and has let a contract for the erection of a modern brick and steel factory 300x50 feet, four stories, to be equipped with electrical power. Orders will be received and executed at the Hartford works as usual until further notice, but early in 1902 they will be moved to Cleveland. The business of the new company will be conducted by those who have been actively engaged in the management of the individual ones. The officers are: W. D. B. Alexander, president; D. Elliott, vice-president; O. S. Werntz, treasurer; A. W. Henn, secretary; E. C. Henn, general superintendent. The company will manufacture for sale the Acme multiple spindle automatic screw machine, together with a full line of cap screws, set-screws and special milled work turned from steel, iron, zinc and brass.

Consul Henry B. Miller reports from Niuchwang that one of the peculiar features of the trade in China is the great quantity of old iron imported—plates, tubes, wagon ties, horseshoes, railway spikes, wire rope, hoops, and general scrap iron. This is worked over, welded together, and put to various uses in the small blacksmith shops throughout the country. It illustrates the intense economy of the people and the small value of labor. The country is being flooded with frauds and imitations; for instance, a can of condensed milk bears the exact eagle of the Eagle brand, but is printed Buzzard brand. The Chinese who cannot read are caught by the figure of the eagle.

MR. SCOTT ON ENGLISH-AMERICAN ELECTRICAL TRADE.

Campbell Scott, of the C & C Electric Company, has returned from a European tour, the larger part of his time abroad having been spent in Great Britain. Mr. Scott remarks that British manufacturers

of electrical machinery, as well as other lines, have been left very much behind the times in their equipment and methods, but they have made improvement of late. In one large engineering works he visited there was apparently not a machine tool less than twenty years old. The tendency of the conservative element is to hold on to such machinery as they have until it falls to pieces. But a more progressive spirit is gaining control. It has become evident that if Europe is to compete with America in manufacturing electrical machinery and the like, American machinery and methods must be availed of. American practice is therefore coming into vogue and the necessity is felt of putting in American tools to a considerable extent, although there is also a strong-seated aversion to doing so. While it may be necessary to import tools from this country for the time being, the disposition is eventually to supplant that necessity by the introduction of the advantageous points of the American tools into those of British construction. It is fair to add that the general feeling toward the United States held in Great Britain seems even more friendly than the reciprocal one.

Mr. Scott says that his company is making no radical departures with reference to the foreign market, and he questions whether the establishment of foreign affiliated plants by some of the other American companies is going to pay. The advantages and disadvantages seem to balance up pretty nearly evenly. On one hand a company building its machinery on British soil has less national prejudice to encounter in marketing its goods than does a purely American one. On the other hand it is cheaper to manufacture in the United States and deliver in England than it is to make the goods in the latter country. This is due in part to the onerous conditions imposed by the British trade unions. They enforce their regulation prohibiting more than one man to work on one tool, even to the point where they will not allow one man to give another a lift. A concern with an organization sufficiently English to be regarded as such by the buyer, yet which privately had its goods made in America, would have a commercial advantage over both the purely British and purely American manufacturer, whatever might be the ethics of the case. British electrical machinery has of late come to approximate American designs, and thus is a more formidable competitor. The prices of theirs and ours are not greatly different. While they cannot build as cheaply as we can, even with the improvements in their methods, they are at present willing to accept narrower margins of profit. There is little prospect that the English demand for our electrical machinery will hereafter be better than it is now, which is not as good as it was at one time.

The foregoing relates to trade in Great Britain. English electrical competition in neutral markets Mr. Scott does not regard as anything to be afraid of. The German competition, however, is nasty. German electrical manufacturers are making exceedingly low prices and introducing a poor class of apparatus. The cheap stuff they build they designate "American," the better stuff they call "German." Machine tools, also, Germany has been and is pouring into England in great quantities at low figures.

CHICAGO MACHINERY MARKET.

The largest prospective business in machine tools in the West for the near future is the order which it is expected the Union Pacific will place for its new shops at Omaha. Perhaps $200,000 will be spent for the equipment. It is currently reported that the electric cranes will cost about $85,000. The iron-working machines will run, it is estimated, from $40,000 to $60,000 and there are many specifications for wood-working tools. The additional shops of the Oregon Short Line at Pocatello, Idaho, will also require quite an equipment, concerning which there are pending negotiations. There are, however, fewer large Western orders in sight for machine tools than graced the horizon several months ago. The number of big contracts closed will be fewer in October, from present indications, than they were in September or in August. John Thompson & Sons, Beloit, Wis., have bought from Hill, Clarke & Co. an order running up to about $6,000, and the Western Machine Tool Works, Holland, Mich., have also bought quite a bunch of tools recently. The latter company will be in operation within a week or two and are booked several months ahead for the uniyersal radial drill which they will manufacture.

While notable transactions are few the volume of October trade in machine tools is eminently satisfactory. There is not a house on the street that does not report an excellent business during the past four weeks, practically a continuation of the business which has been in evidence for the past three or four months. The mails bring many orders for a few tools each and the storerooms on Canal street are well visited by out-of-town machinists, who rarely depart from the city without leaving behind verbal orders for the machinery needed in their shops. The aggregate of this business is very large and has been shared by all factors to the local trade. One dealer observes, by way of corroborative evidence that these conditions will endure for a time, that among his customers have been a number of machinists who have lately started up small shops of their own, taking the cue from the overburdened conditions of the shops of their former employers that the time was auspicious for advancing their business status.

John H. Dawson says October will be one of the largest months in his experience. The business is composed almost exclusively of small and medium-sized orders. He has lately secured the Western agency for the W. P. Davis Machinery Company lathes, and is arranging for other machine-tool representations.

The Niles Tool Works are running full. The pressure for large tools has been so severe that it has been impossible to accumulate a desired stock of small machine tools at the works.

The Armstrong Brothers Tool Company, Chicago, has just received an order from the Mexican Central Railway Company, Limited, for over 200 Armstrong tool holders, mostly of heavy sizes, and a large quantity of steel for use in same, the order amounting to over $1,000. The road had previously placed several small orders with the company for tool holders and had given them a trial.

Wood-working machine tools are as much in demand as at any time last summer, when, as previously noted, there was in place of the usual lull a remarkably heavy trade.

Charles H. Besly & Co., Chicago, Ill., report their general business very good. They are especially busy in the tap and grinder departments of their factory at Beloit, Wis. Their foreign trade, as well as the domestic, is excellent, many orders being received from South America, England, Germany, Norway and Sweden.

Quotations.

NEW YORK, Monday, October 28.

Pennsylvania Foundry Pig Irons, Jersey City delivery:

No. 1 X	$15 15 @ $16 15
No. 2 X	14 65 @ 15 15
No. 2 plain	14 15 @ 14 65
Gray forge	13 50 @ 14 00

Alabama Pig, New York delivery:

No. 1 foundry, or soft	15 50 @ 15 75
No. 2 foundry, or soft	14 75 @ 15 00
No. 3 foundry	14 25 @ 14 50
Foundry forge, or No. 4	13 75 @ 14 00

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.68c. in carload lots, but an advance of .05c. is talked of. From store, 1.90 @ 1.95c. in small lots.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—1.90 @ 2.00c. from store.

Cold Rolled Steel Shafting—Base sizes—From store, 2¼ @ 2½c., the lower price being exceptional.

Copper—Lake Superior ingot, spot, 16¾ @ 17c.; electrolytic, 16½ @ 16⅝c.; casting, 16 @ 16¼c.

Pig Tin—In 5 and 10-ton lots f. o. b., New York, 25c.

Pig Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—4.30c., New York delivery.

Antimony—Cookson's, 10¼ @ 10⅜c.; Hallett's, 8¼ @ 8⅜c.; U. S., Hungarian, Japanese and Italian, 8⅛c. upward.

Lard Oil—Prime City, 74 @ 76c., in wholesale lots.

Manufacturing Worms and Worm Gears.

BY W. E. WILLIS.

Worm gears may have their teeth produced in several ways, as cast, finished cast, straight cut, drop cut or hob cut.

Common cast teeth are invariably rough, usually mis-shapen and little used, except in rough, cheap work; never where any degree of refinement is required. Franklin process, or finished cast gears, may sometimes be economically employed, if of small size, for light duty and when large quantities are used. Straight cut worm gears are formed similarly to spur gears, the teeth running across the straight face of the blank, but at an angle thereto, corresponding with the pitch of the worm; they may or may not be bevelled on the edge, but are not concaved; it is the cheapest form of tooth ordinarily made, no special cutters or hobs being needed. Drop cut teeth are formed by lowering a cutter into the previously concaved face of the blank, the cutter having a relation in diameter to that of the worm to be used and the blank set at an angle corresponding with the teeth of the worm. In appearance the drop cut tooth resembles the hobbed tooth, but it is not nearly so perfect, although frequently employed in large gears.

Hob cut worm gears have their teeth cut in the prepared, concaved face of the blank—which is afterwards bevelled—by a cutter which is practically a duplicate of the worm to be used in connection with the gear; before hobbing, they are usually nicked or gashed with a milling cutter, as in making a drop cut tooth, so as to leave but a minimum of stock to be removed by the hob. While it is true that the expense of making a special hob is considerable, if there are any number of gears to be made, or the correct shape is desirable, the results may well warrant the cost.

The object of the device shown in Fig. 1 is to produce small worm gears quickly and correctly; little or nothing depending upon the skill or experience of the operator. The blank need not even be turned to an accurate diameter, while concaving the face or gashing for the teeth are both entirely unnecessary, in fact detrimental.

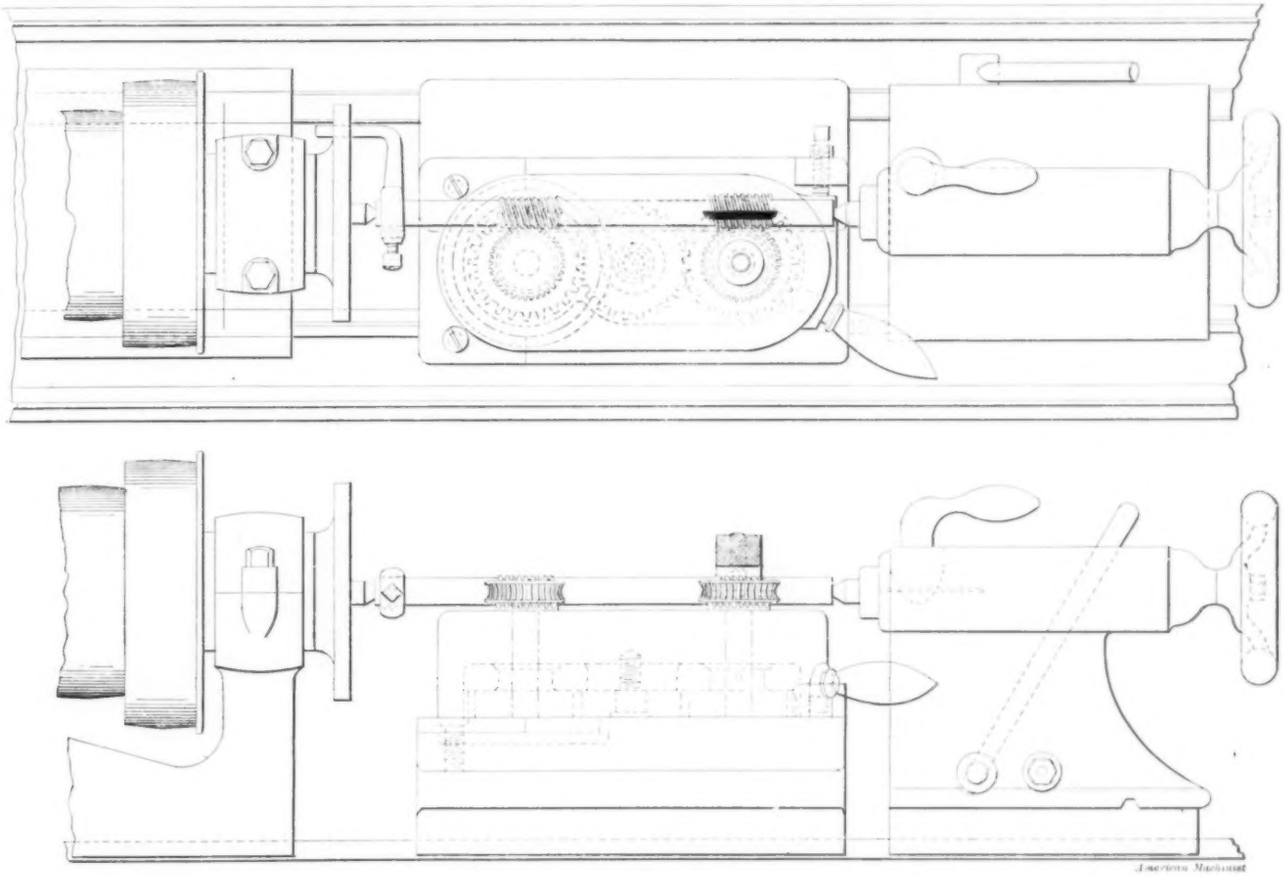


FIG. 1. WORM GEAR HOBBING ATTACHMENT.

The cutting device consists of an arbor, having on it a duplicate of the worm, as a driver; a hob, provided with machine relieved teeth, like those of a formed milling machine cutter, and capable, like it, of being ground in the same way without losing its shape and very little of its size.

The fixture proper has a bed plate, fitted and secured to the bed of a lathe, or similar machine, having centers for supporting and conveying motion to the hob arbor. The upper part of the fixture is arranged to swivel or partially rotate around the vertical center of the coadjutor, or first driving gear, meshing with the worm, in a horizontal plane. Attached to the lower end of the coadjutor gear spindle is a driving spur gear, entrained, through an intermediate, with another on the lower end of the work spindle, which projects up through the frame of the fixture, so as to bring the uncut blank into the proper position to be operated upon by the hob on the arbor. As motion is transferred by the worm on the arbor through the gearing in the fixture, the blank being rigidly secured to the projecting end of the work spindle, it is evident that the blank will be caused to positively rotate, in the right direction and at the proper relative speed to be operated upon by the relieved hob. The upper part of the fixture, along with the blank gear, is fed, or swung, forward, turning about its pivotal point, against and into the cutting hob, by the operating handle or lever, until further motion is arrested by the stop-screw, which, once correctly adjusted, assures that all the gears to be cut will be of like diameter. The arbor need not be stopped while changing blanks, and the speed of the cutter may be at a comparatively high rate.

In practice it has been found possible to cut and finish bronze worm gears, 10 circular pitch, 2 inches diameter, 3/8-inch face, with this arrangement in less time than it had formerly taken to gash half the way around the blank in a milling machine (averaging 20 seconds), besides the time saved in sizing and concaving the blanks. In another case, a gear of 10 cir-

cular pitch, 12 teeth, ⅛-inch face, was regularly finished in three seconds.

As will be evident from inspection, either right or left-hand gears may be cut with equal readiness, the driving worm, worm gear and hob being made of the desired lead, pitch and single or multiple thread as required. While the writer has had no opportunity to try this device upon work of a large character, it is not apparent why it is not equally applicable.

What is thought to be a new, original, expeditious and entirely accurate method of cutting small worms from bar stock by the solid bar, ½-inch outside diameter, of double thread, to engage with a gear of 36 teeth, 1-inch pitch diameter, giving a proportion of 18 to 1.

The driving gear is mounted upon the nose of the machine in such manner as to transmit motion to an idler running free upon a stud in the fixture. On the face of this idle gear, near its edge, is a stud carrying a freely revolving pinion, engaging with a gear rigidly affixed to the head of the stud on which the idle gear revolves. Alongside of this gear is another, of the same diameter, but having spindle by adjustable nuts above and below it, to make up for reduced thickness in grinding, or it may rest on the solid collar as shown; it is in effect a steel duplicate of the worm gear to be used, cut through a median line, relieved, hardened and ground, producing necessarily a conjugate worm.

In operation the rod is fed forward by the usual means against a stop; the cutter, which is at all times revolving, is brought up and held against the rod until further forward motion is arrested by a stop (not shown), thence released or dropped forward out of the way and the turret tools used in other operations; the last being a cut-off tool in the cross-slide, set at the rear, with sufficient offset to clear the fixture.

Obviously by changing the relation of the epicyclic gearing and the cutter, the opposite hand worm would be produced, and it is equally evident that a wide range of threads can be cut by corresponding changes in the proportions of gearing.

The shape produced by this device is of the well-known Hindley or hour-glass type, which, so the writer is informed, has the approval of the United States Naval Department, which has adopted this type

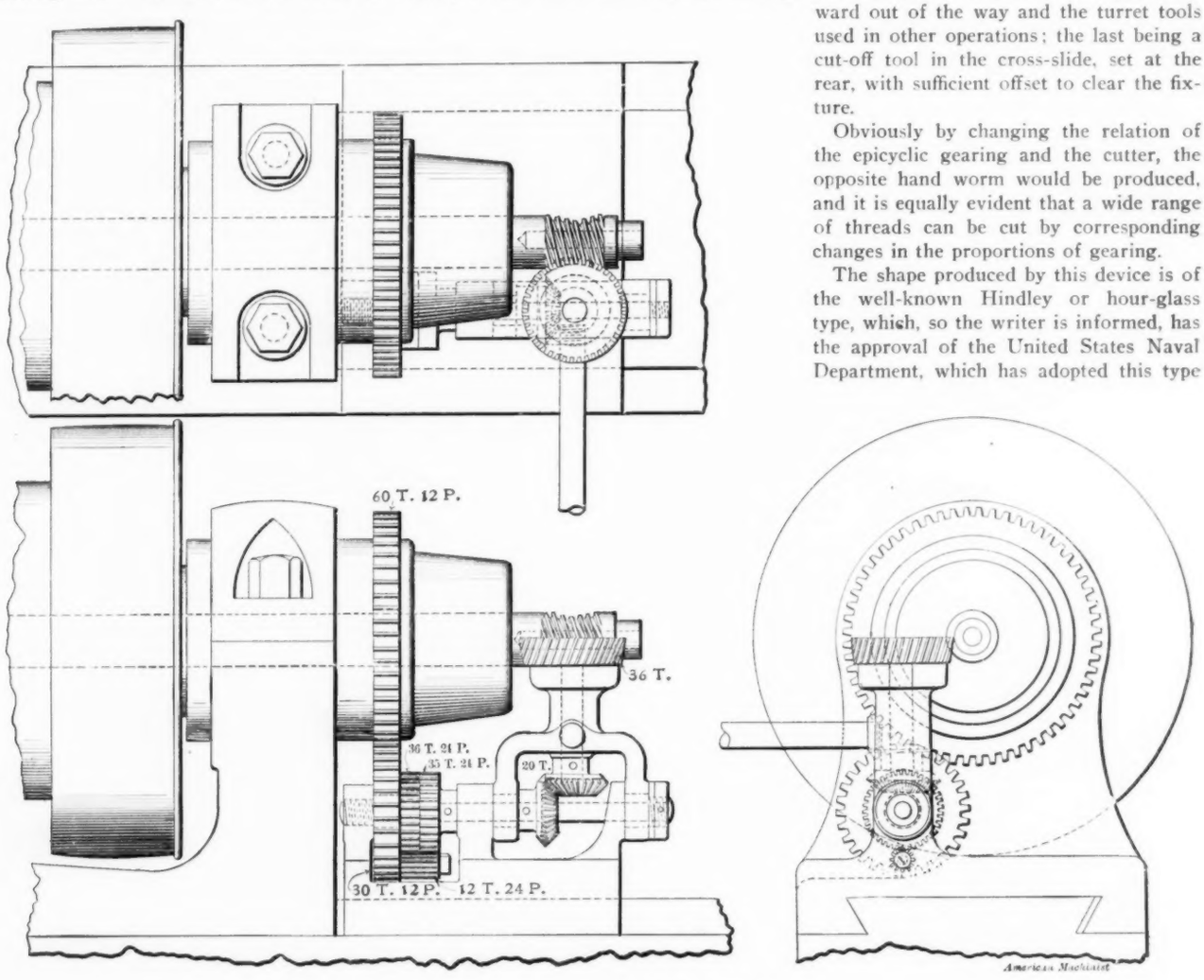


FIG. 2. THREADING WORMS IN THE TURRET LATHE.

means of a rotating, formed cutter is shown in Fig. 2.

As will be seen, it consists of an attachment to a screw machine, that in no way interferes with its ordinary functions, which are used in the ordinary manner in sizing the stock, turning the hub, drilling and finishing the hole, etc. No chasing bar or dies are needed, for the threads are cut absolutely correct in every respect by the revolving cutter at a rate thought to be unprecedented.

The drawing—which is about to scale for the worm shown—shows the device as arranged for cutting bronze worms from one or more less teeth, into which the pinion meshes, and being fast to a horizontal shaft, supported by bearings in the framework of the fixture, conveys motion to a bevel gear near its outer end, meshing in turn with another upon the vertical cutter shaft. In other words, so far, it is a practical application of an epicyclic train.

The cutter spindle may be freely rotated in its bearings, which are adapted to partially turn or swing to and from the work by a hand lever. The cutter, which is very similar to that used in the Fellows gear shaper—whose excellent work is well understood by mechanics—may be held on its

wherever worms and worm gears are used, on account of their superiority.

From the peculiar shape of the worm or screw thus obtained it will be seen that there is a constantly changing variation of pitch from top to bottom of teeth. This variation exactly corresponds with the varying diameter of the teeth in the wheel, thus giving a practically perfect bearing the whole length of the worm, which distributes the strain and wear over far more bearing surface than in the straight or common worm, which tends to reduce the friction and requires less power to drive. Further, as the diameter of the worm con-

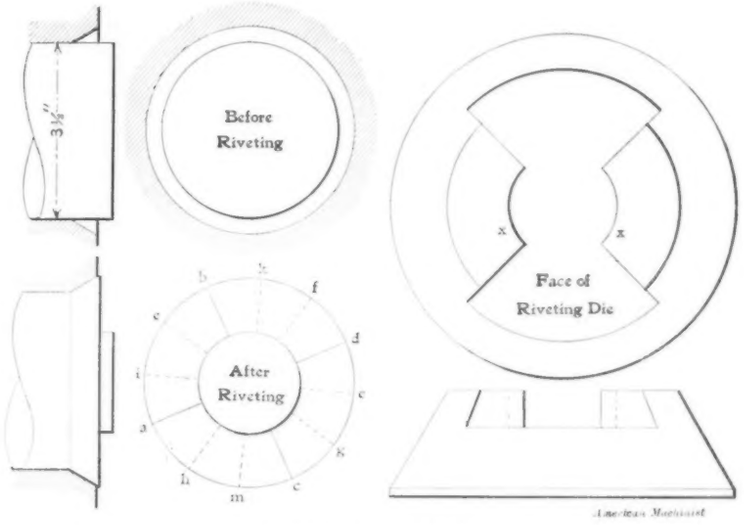
stantly changes as it revolves, one tooth or thread does not exactly follow in the path of the one preceding it, rendering it less liable to unduly wear either the worm or gear.

It is confidently believed that the advantages of this style of worm would have caused it to supersede the straight cut worm but for the extraordinary expense involved in producing them; hence where quantities of small or medium sizes are required this device may prove useful.

Heavy Hydraulic Riveting.

The simple job of erecting a steam engine is one which calls for special facilities and which involves some interesting mechanical operations when the engines happen to be of the weight and dimensions now not infrequent, especially in connection with electric light and power installations. Where an engine weighs more than 500 tons, the mere handling and placing of the heavy pieces which compose it would once have been a serious problem, but this is happily and completely solved by the traveling crane, which is usually the first mechanism erected in the installation of a modern plant. With the means of easily placing each piece in its precise position, the bolting together of the successive related pieces also becomes a simple matter where bolting or kindred devices apply. In the assembling of the flywheel, however, something more than this is called for. This is happily illustrated in the case of two 5,000 horse-power vertical compound engines, whose erection is now practically completed for the Brooklyn Edison Electric Light Company at Bay Ridge. The engines, which weigh over 500 tons each were built and erected by the Westinghouse Machine Company, and by the kindness of Mr. Robert M. Hughes, in charge of the erection, we were recently permitted to see the completing operation in the assembling of the flywheel of the second engine.

This operation was the riveting of the rim. The wheel weighs, complete, about 160 tons. It is 28 feet in diameter, and the section of the completed rim is about 26 inches square. There are ten arms bolted between flanges, which form the hub of the wheel. Integral with each arm is a segment of the wheel rim, but considerably thinner than the rim when complete. This central portion of the rim is completed in width and bound together by the addition of a ring on each side composed of five steel segments of the full depth of the rim and about 7 inches thick. The segments of the steel rings are of course so placed as to break joints with the central portion and with each other, and then laterally through the completed rim are placed seventy-five steel pins, 3½ inches in diameter, which, when in position, are riveted on each end, and the wheel is then complete. The steel rings have been machined all over and provisionally drilled at the works, but have not been assembled on the wheel. When they are in place, however, and secured by large temporary bolts the surfaces of the periphery and of the sides are such a perfect match and the joints are so imperceptible that it is not easy to believe that all has not been turned off together. The radial joints of the steel plates are drawn and held together by T-headed binders which are shrunk into machined recesses, which they neatly fit. After this the holes for the rivets are first bored.



RIVETING A FLYWHEEL.

This operation as well as the riveting is done by portable tools, but the "portable" idea is in this case a large one. The holes, which have been previously drilled, leave about ½ inch for the final boring and reaming. The boring machine is placed in position at the side of the rim, with means of readily moving it inward or outward radially, as the holes to be bored are located at three different radial distances. The holes are brought to the position desired in the other direction by simply turning the wheel in either direction, which is done by the aid of the traveling crane. The minute final adjustments required are provided for in the boring machine itself. When the holes are bored and reamed the pins are inserted, and these are all a tight and perfect fit. They are partly driven by a ram, and usually brought home, so that they project equally on each end, by the assistance of the hydraulic pressure.

The hydraulic riveter is another "portable" tool. It consists essentially of two levers jointed opposite each other with a long arm and a short arm to each. These lie horizontally upon a car which can be moved in or out radially of the wheel. Between the long arms of the levers is a 10-inch hydraulic cylinder and piston by which the squeeze is effected at the other ends. Heavy springs are provided to draw the levers together when the water is released. In the sketch *A* shows the projecting end of a pin before the riveting, and *B* shows the rivet after the operation. *C* shows the face of the riveting die. One of these dies is clamped to each jaw by a ring which sets over the conical part and holds the die so that it may be easily turned. Both ends of the rivet are done at the same time. The die, it will be seen, leaves a circular portion in the middle of the rivet uncompressed, and it in the first squeeze takes only one-half of the periphery, or one-quarter on each side. To make this squeeze, something like 400 tons pressure is applied. The pressure being released and the jaws opened, if the dies were each turned 90 degrees a second squeeze would complete the rivet; but it is found preferable to turn the dies only about 60 degrees at a time and to do the work in three compressions, thus letting the jaws of the die successively lap over a portion of the previous compression. In this way a much smoother surface is left on the rivet. In some cases, if, for instance, either or both ends of the rivet are rather short, the central portion may be first compressed, which is done by inserting a hardened cylindrical plug in the middle of the die and long enough to project a sufficient distance above the faces of the jaws *x*. When everything is in position and all ready for the riveting the actual operation does not take more than a couple of minutes. The riveting shows the perfect plasticity of the metal when sufficient force is applied to it.

When the riveting is completed, the riveter is removed and the boring machine is brought into play again, this time for facing off the projecting portion of the rivet flush with the side. In this case the wheel is blocked and the vertical motion of the cutter spindle carries the mill over the surface. Both the boring machine and the pumps for the riveter are electrically driven. When in use, the pump runs continuously, and the pressure upon the riveter is controlled by a handy by-pass valve.

The Strength of Flat Plates—II.

BY ALBERT E. GUY.

ANALYSIS OF SOME EXPERIMENTS.

In Mr. W. Kent's "Mechanical Engineer's Pocket Book" there is a chapter treating of the strength of flat plates, in which, under the subtitle of "Strength of Unstayed Flat Surfaces," there is to be found an extract of an article which appeared in the columns of "Engineering" of September 28, 1877 (Vol. 24, page 239). This article, by Robert Wilson, describes some experiments on flat plates, contains a really-painful-to-read analysis of them, and, because the experimenters made an awful series of *quid pro quos,* ends by casting anathemas right and left on all such great mathematicians as Grashof, Lamé, Rankine, Resal, etc. The experiments, however, although not made with all the care desirable, have been recorded in the said article, and in making a brief analysis of them we will find that they serve the purpose to illustrate the fact that, in the art of the engineer, it is often more difficult to discern the correct formulas governing certain cases than to apply them.

An experimental boiler was made, having a cylindrical shell, 24 inches long and 30 inches in diameter, of 7-16 inch plate, the ends of which were butted together and covered with a double riveted butt strip.

Experiment 1.—One end of the boiler was made with a flat ⅜-inch plate, flanged, and of ordinary workmanship. The diameter of plate at root of flange was 28 inches. The other end was a 9-16 inch flat plate, secured to shell by a stout outside angle-iron. The pitch circle diameter of the rivets was 34½ inches. The rivets were ⅞-inch diameter, 2¼-inch pitch. The tensile strength of the flanged plate was 20¼ tons along, and 19½ tons across the fiber, the stretching being 7 per cent. The pressure was applied inside the cylinder by means of a hydraulic pump. The 9-16 inch plate gave way, under a pressure of 280 pounds per square inch, by bursting through the circular line of rivet holes with a sharp report. Although the actual rent was only 15 inches long, the plate was nearly broken through at the opposite side, and on inspection was found to be cracked from rivet hole to rivet hole all the way round. The curve of this riveted plate under pressure was an arc of circle, having a chord 34½ inches long with a deflection of 1¾ inches, without contrary flexure, *and unlike the curve of the flanged plate, which showed contrary flexure,* the plates deflected almost as soon as any pressure was put upon them, and as the pressure increased they took permanent sets.

The experimenters, upon applying Grashof's formulas to this case, found that the thin plate should have given way under a pressure of 40 pounds per square inch, and of 63 pounds for the heavy plate. Consequently they were greatly surprised because the bursting pressure was so high and the heavy plate broke first.

Now, we see that the plates deflected as soon as any pressure was applied, and that, at the bursting point, the 9-16 inch plate had become in reality a portion of a spherical shell having a chord equal to 34½ inches, with a versed sine of 1¾ inches; consequently it had changed form, was no more a flat plate, and should not have been calculated as such. In order to calculate the probable bursting of the plate we will make the following assumptions:

(1) The plate is a portion of a spherical shell.

(2) It should give way at the weakest place—*i. e.,* at the pitch line of rivets, where holes of about 15-16 inch diameter must have been punched.

(3) It should give way first in the direction of the least tensile strength—*i. e.,* across the fibers where the strength is 19½ tons per square inch. These tons are supposed—other information lacking—to be of 2,240 pounds; hence the tensile strength is 19½ × 2,240 = 43,680 pounds per square inch.

The radius of the sphere is obtained by the equation:

$$r = \frac{\frac{a^2}{4} + b^2}{2b}$$

which is clearly indicated by Fig 1, where b = deflection = 1¾ inches and a = chord = 34.5 inches.

Hence $r = \dfrac{\frac{(34.5)^2}{4} + (1.75)^2}{2 \times 1.75} = 85.89$ in.

The diameter of the sphere is 85.89 × 2 = 171.78 inches. The bursting formula is:

$$p = \frac{4 f t}{d}$$

where f = tensile strength = 43,680 pounds per square inch, t = thickness of plate = 9-16 inch; therefore

$$p = \frac{4 \times 43{,}680 \times 9}{171.89 \times 16} = 572.13 \text{ lbs. per sq. in.}$$

If the shell had been solid this would have been the bursting pressure, but as it was perforated to accommodate the rivets, we must make an allowance therefor.

The pitch circle being 34½ inches diameter, the circumference is 108.385 inches, and as the pitch was 2¼ inches, the number of rivets was $\frac{108.385}{2.25} = 48.17$, or, in round numbers, 48.

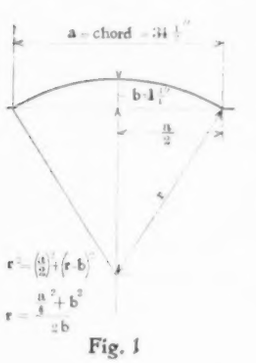


Fig. 1

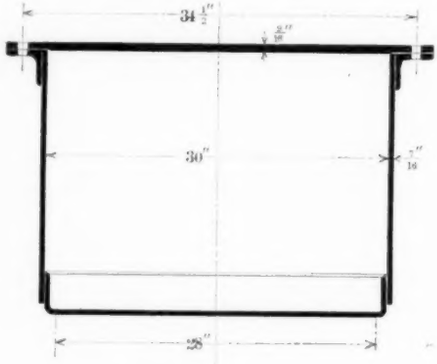


Fig. 2

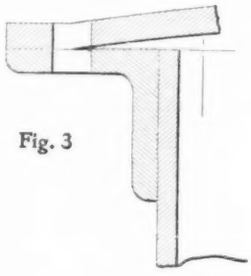


Fig. 3

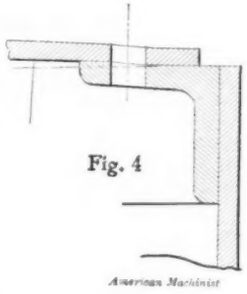


Fig. 4

WILSON'S EXPERIMENTS ON THE STRENGTH OF FLAT PLATES.

The holes being 15-16 inch diameter, very likely for ⅞-inch rivets, the length of metal removed on the pitch circle was:

$$\frac{15 \times 48}{16} = 45 \text{ inches.}$$

Hence 108.385 — 45 = 63.385 inches represent the length of the useful metal on the pitch circle where the fracture took place.

The ratio $\frac{63.385}{108.385} = 0.5848$ represents the actual strength of the plate as compared with that of a solid shell, and if we multiply the bursting pressure found above by this ratio, we find the pressure required to break the plate, thus:

572.13 × 0.5848 = 334.58 pounds.

The observed pressure was 280 pounds. The plate was not as strong as a real spherical shell would have been, because there must have been quite a sharp bend at the line of rivets; besides, we do not know how the deflection was measured, or if the one stated, 1¾ inches, was taken from the rivet line to the apex of the plate.

The question which worried the experimenter so much can now be easily answered. Why did the 9-16 inch plate break instead of the ⅜-inch one? Firstly, considered as flat plates, the ⅜-inch one had a diameter of 28 inches at the root of flange (see Fig. 2), whereas the other had a diameter of 34.5 inches at the rivet circle. Then the thin plate was whole; the other being weakened almost one-half by rivet holes. Finally, the 9-16 inch plate was neither supported nor firmly held, according to the true meaning of these two expressions as applied to the flexure, but was in an intermediate condition rather difficult to define, whereas the ⅜-inch plate was almost rigidly held; the advantage, as far as resistance is concerned, being with this latter condition. If the experimenters had given us the co-ordinates of the point of contrary flexure as well as the corresponding deflection of the plate there would have been no difficulty in determining the bursting pressure for the thin plate.

Experiment 2.—The 9-16 inch plate was replaced by a ⅜-inch plate, the angle-iron and riveting being the same as before—⅞-inch rivets at 2¼-inch centers. This ⅜-inch plate, which had a tensile strength of 20.83 tons per square inch, gave way under gradually applied hydraulic pressure at 200 pounds, at which it stood for about two minutes. The fracture was of a similar nature to that of the 9-16 inch plate. The deflection was 1 7-16 inches.

Following the same method as before, we see that the plate took the form of a portion of a spherical shell subjected to internal pressure. The chord was 34½ inches; hence the radius of the sphere was:

$$r = \frac{(34.5)^2}{4} + (1.4375)^2 = 104.22 \text{ inches},$$
$$2 \times 1.4375$$

and the diameter: $104.22 \times 2 = 208.44$ inches.

Applying again the formula:

$$p = \frac{4ft}{d}$$

we have for $f = 20.83 \times 2{,}240 = 46{,}660$ pounds, and for p:

$$\frac{4 \times 46{,}660 \times 3}{208.44 \times 8} = 335.77 \text{ pounds}.$$

This is the bursting pressure required for the whole shell; multiplying this by the same ratio as before, since the riveting is the same, we have:

$$335.77 \times 0.5848 = 196.37 \text{ pounds}$$

for the calculated bursting pressure of the actual plate. The observed pressure was 200 pounds per square inch.

Experiment 3 was of no account.

Experiment 4.—Both ends of the cylindrical shell were cut off, and an inverted dished ⅜-inch plate replaced at one end. The other end was a ⅜-inch plate secured by an inside angle iron 3x3x½ inches, and ¾-inch rivets at 2-inch centers; diameter of plate between holes, 26¼ inches. The tensile strength of this plate was 19.66 tons per square inch.

The ⅜-inch plate gave way at a pressure of 371 pounds per square inch, by fracturing through the rivet holes in a manner similar to the other flat plates secured by outside angle irons. The deflection at the breaking pressure was 1¼ inches and the permanent set 1⅛ inches.

The probable radius of the spherical shell thus formed was:

$$\frac{(26.25)^2}{4} + (1.25)^2 = 69.53 \text{ inches}.$$
$$2 \times 1.25$$

Diameter $= 69.53 \times 2 = 139.06$ inches.

The bursting pressure for a tensile strength of 19.66 tons, or $19.66 \times 2{,}240 = 44{,}038$ pounds, was:

$$\frac{4 \times 44{,}038 \times 3}{139.06 \times 8} = 475 \text{ pounds for the whole plate.}$$

The circumference of 26¼ inches diameter = 82.467 inches, hence the number of rivets: $\frac{82.467}{2} = 41.233$, or in round number 41.

$$\frac{41 \times 13}{16} = 33.3125 \text{ inches}.$$

$$\frac{82.467 - 33.3125}{82.467} = 0.59607 = \text{ratio}.$$

The calculated bursting pressure is then:

$$475 \times 0.59607 = 283.13 \text{ pounds per square inch.}$$

As the actual bursting pressure was 371 pounds, it seems that we have struck what is termed, in shop parlance, a snag. Of course, the method we are employing is only approximative and the difficulty is increased because of the lack of precise information about the experiments; but, upon comparing the way of securing the plates in the first and second experiments and that of the fourth, an explanation of the trouble presents itself. We see, Fig. 3, that in the first cases, with the outside irons, the plate, in deflecting, was drawn away from the angle, which itself must have been slightly bent, and the pressure was applied very close to the pitch line of rivets. The consequence was that, beside assuming a spherical form, the plate was bent abruptly at the rivet line and thus greatly weakened, which fact easily explains why the actual bursting pressure was so much less than the calculated for the heavy plate. That the difference between the actual and calculated pressures for the 9-16 inch plate is so great is most probably due to the influence of the thickness of the plate. The ⅜-inch plate was more readily kept in place by the rivets which were relatively heavy for it, while the heavier plate was able under pressure to slightly distort the rivet heads to accommodate its bending.

With the inside angle iron, Fig. 4, the plate, in deflecting, assumed the spherical form, but as the angle itself must have also bent, it kept contact with the plate with the results: First, that this latter was not subjected to the pressure on all its surface (measured by the area of the pitch circle) and was probably but slightly bent at the rivet line; second, that the plate benefited by the pressure and frictional resistance due to riveting. Consequently the plate thus secured was in a better condition than the two first plates to withstand a much greater pressure than that calculated.

We may conclude that the experimenters were evidently unaware:

First, that the rules established for the strength of materials are generally meant to apply only inside the limits of elasticity.

Second, that as soon as the limits were exceeded, the conditions as well as the form of the plates being altered, different methods of investigation were required.

Third, that even in the case of flat plates within the elastic limits it is difficult to obtain in practice the exact conditions for which the rules were established; as, for instance, a plate uniformly loaded and supported at the edge—that is, resting upon a support, or one rigidly held at the edge—that is, with the supposition that the support is absolutely rigid and the plate absolutely fixed to it. The riveting of the plate cannot be considered as a rigid hold, because the plate is weakened by the rivet holes; the flange of the plate, although quite rigid, can be deflected by the pressure and by the bending stresses developed in the plate, and besides it is difficult to ascertain the proper point at which the plate ceases to be flat.

Fourth, that it was not proper to consider in the same light the plates secured to outside angle irons and that fixed to the inside angle. The conditions, as we have seen, were different, for in one case the pressure tended to separate the plate from the angle, whereas in the other it brought them closer together.

Experimenters wishing to verify or to establish laws governing the strength of materials should endeavor to proceed from the simple to the complex. Unfortunately, the exceptions seem to rule in practice, and people are too apt to experiment thereupon and to apply thereto the conclusions intended for the basic principle of the case. In meeting with unsuccess, instead of entertaining a reasonable doubt as to the correctness of their mode of procedure, they feel absolutely confident of themselves and berate those who have arduously built the theories. The example we have here in the case of Mr. Wilson's article is not of great importance, because a simple reading of the article shows at once that the experiments made were rather crude and could not be fertile in results; but other experimenters, such as Hodgkinson and Fairbairn, for instance, have been very influential—the former, by his incomplete experiments on columns in causing the admirable work of Euler to be ignored by a great number of engineers, whereas, by carefully conducted tests, the latter's formulas on columns can be easily proven true—and the latter, by his equally incomplete experiments on collapse of tubes, in

inducing many engineers to consider this question as solved, whereas it had been only touched by him, and not in the correct way at that.

In "Engineering" of December 13, 1895, there is quite a notice about Mr. Kent's "Mechanical Engineer's Pocket Book," the first edition of which had just appeared. The following extract of that article is quite remarkable: ". . . Flat plates are also dealt with at considerable length, and in addition to the usual formulas a short account is given of Mr. Wilson's experiments, the result of which did not agree with those deduced by elasticians. Mr. Wilson, however, failed to recognize that the rules in question were only intended to have been applied within the above that permissible by formula can be relied on. . . ."

After a lapse of eighteen years the editorial staff of "Engineering" found it necessary to atone for Mr. Wilson's misstatements. It is highly to be regretted that Mr. Wilson's article was given such a prominent position, being printed on the first page of the said issue, without an editorial notice calling attention to its apparent misgivings, thereby inviting discussion, whereas, on the contrary, it seems to have met the sanction of the editor. If the article had been discussed, certainly Mr. Kent, who has evidently taken great pains to secure the most reliable information for the use of engineers, would have omitted it from his excellent hand book.

supplied to the machines by this department.

Fig. 21 is a view in the foundry. The main bay is served by a 10-ton, three-motor electric crane. The smaller parts are molded on pneumatic molding machines, of which there are two sizes, and these machines and also the shop generally are served by pneumatic jib cranes, several of which can be seen in the photograph, attached to the stanchions.

The driving and lighting of the small tool department and of the erecting shop is by means of electric current, a voltage of 210 being used. Motors are employed for driving groups of machines, and many of these are situated in the roof. The machine shops are at present driven by means

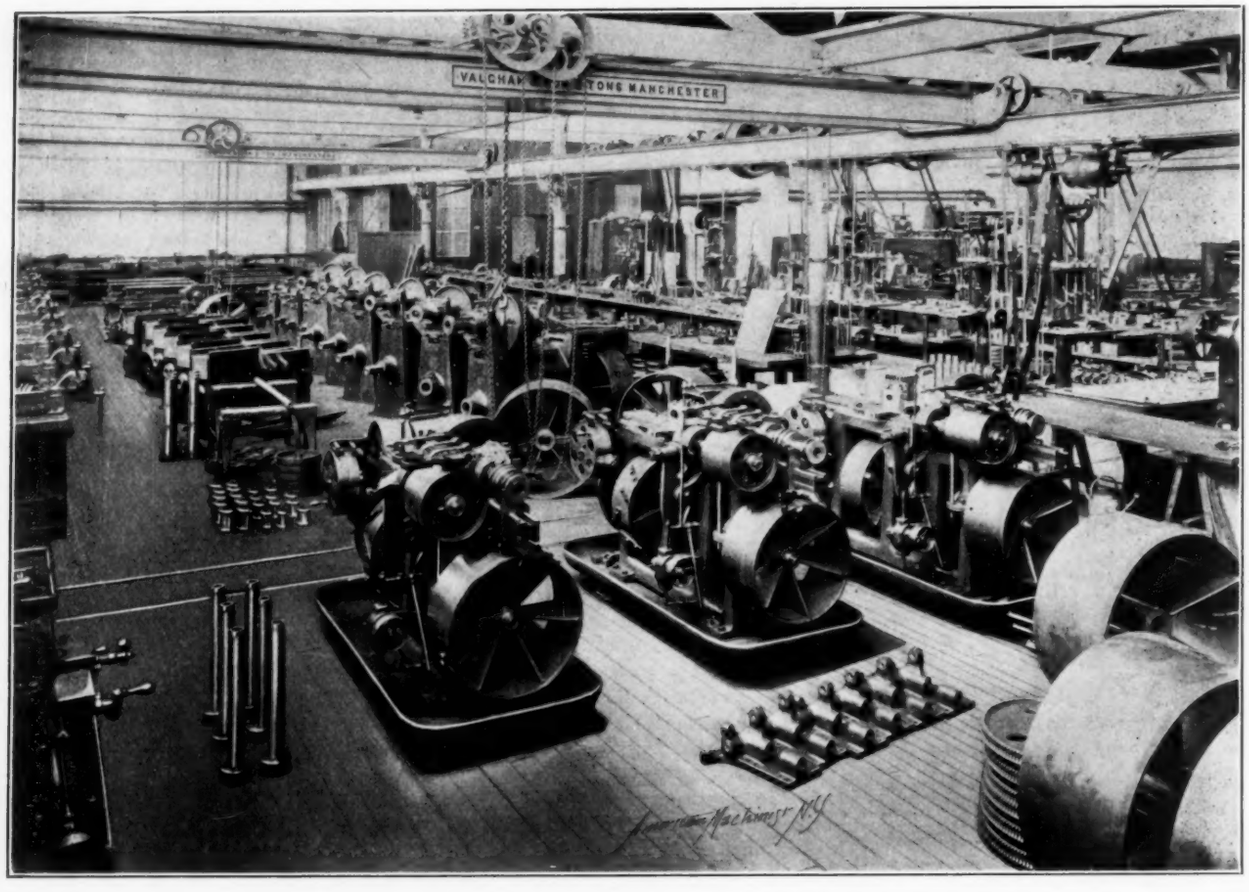


FIG. 18. VIEW IN ERECTING SHOP—ALFRED HERBERT, LTD., COVENTRY, ENGLAND.

elastic limit, within which they are doubtless sufficiently trustworthy. Outside of that limit the strength of the plate is very materially increased by plastic yielding, just as in the case of a solid beam. They may thus, where a considerable deflection is no objection, be safely loaded very considerably in excess of what they would carry if the material remained perfectly elastic up to the point of fracture, but in such cases the load must be applied in one direction only, as alternating stresses exceeding the elastic limit will quickly cause fracture. In the case of a piston, therefore, no increase of strength over and

The Works and Some of the Product of Alfred Herbert, Ltd., of Coventry, England—III.

In conclusion of our account of the above-named works, Fig. 18 is another view in the erecting shop, and Fig. 19 a view of the stores, in which a stock of completed parts of machines is carried and here all finished parts are inspected.

Fig. 20 is the tool-grinding department. This is for the production of ordinary lathe and planer tools. No grindstones are used in the works; all tool grinding is done by emery wheels, and all cutting tools are

of belts, but it is intended eventually to change over the whole system to motor driving. The power is derived from one 220 horse-power high-speed engine of the Westinghouse type, manufactured by Messrs. Alley & Maclellan, of Glasgow; one 75 horse-power high-speed Robey steam engine and one 44-kilowatt Westinghouse engine and dynamo combined. The steam is supplied from two Babcock & Wilcox water tube boilers with Scotch furnaces, the steam pressure employed being 180 pounds to the square inch.

The millwrights' shop is in a separate building, and is provided with a complete

FIG. 19. VIEW IN STORES DEPARTMENT.

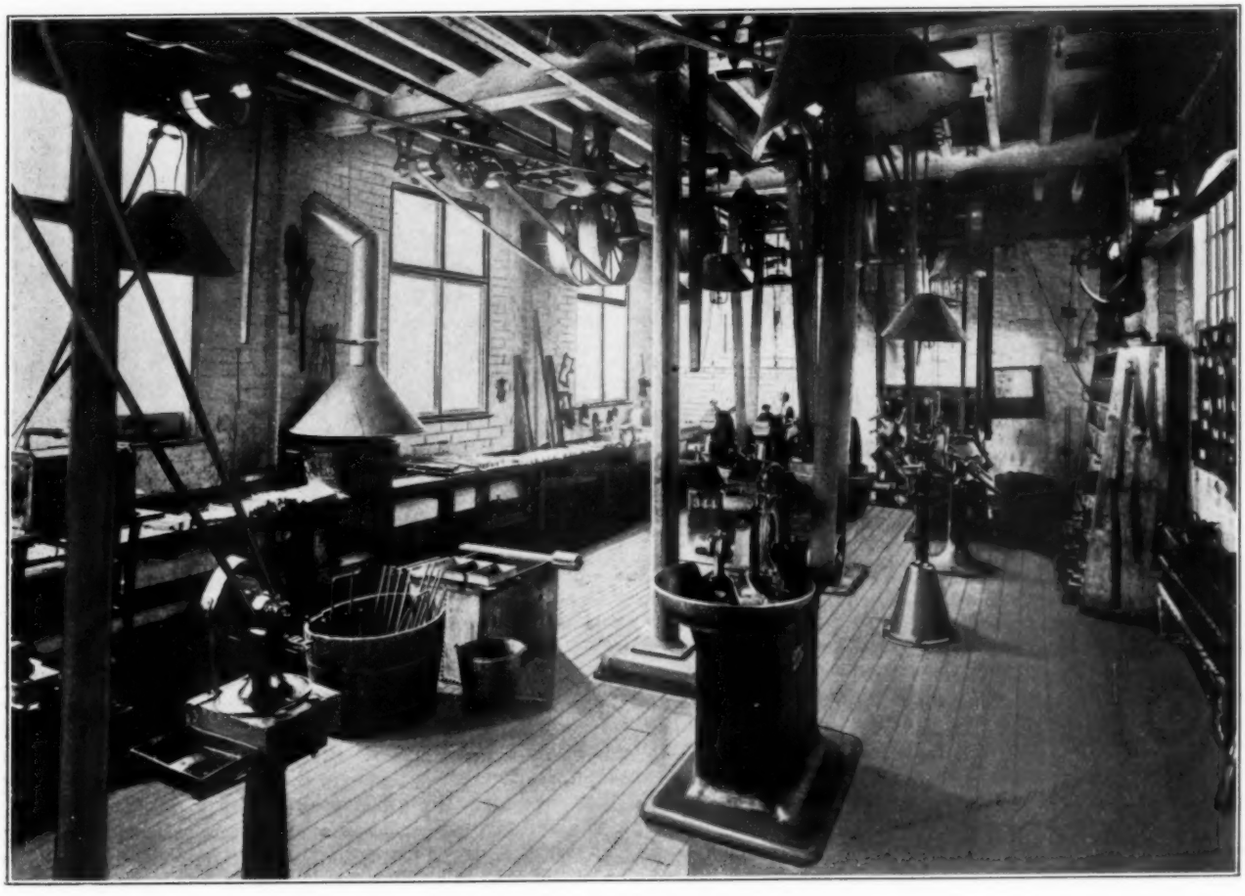


FIG. 20. TOOL-GRINDING DEPARTMENT.

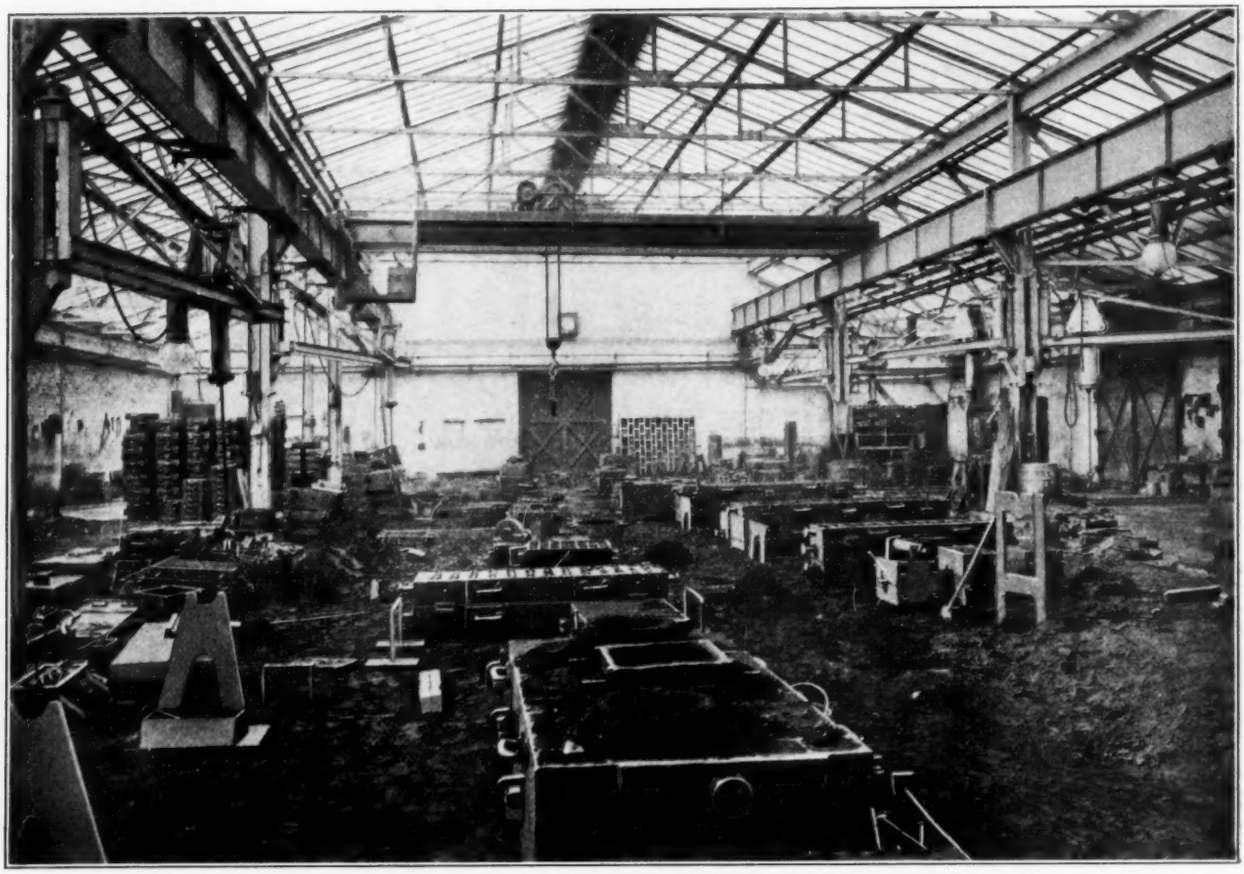


FIG. 21. VIEW IN THE FOUNDRY.

equipment of machine tools driven by a gas engine. This enables the millwrights' department to work when the rest of the shop is closed down—a very important thing in case of breakdowns or when making repairs during holidays.

A messroom is provided for the men, and this is governed by a committee elected by the men. Lavatories for washing up are provided and are supplied with hot and cold water. There is also a club and institute adjoining the works. This has lecture rooms, reading room, smoke room, class rooms, library, bath, etc. It is managed by a committee composed entirely of workmen, and there is a small annual subscription, the amount depending upon the man's rating. In the winter weekly lectures are given and discussions held, the lecturer being generally provided from among the staff. The question as to whether a charge for subscription should be made or whether everything should be entirely free was left to the men, who unanimously decided in favor of making a subscription.

The drawing offices cover nearly 3,000 square feet and employ a staff of about twenty-seven draftsmen. The work is divided broadly into three departments, viz.: shop tools, etc.; small tools for turret lathes and automatics for customers and machine tool design. Each department has its own staff, who are specialists on the particular class of work under their charge.

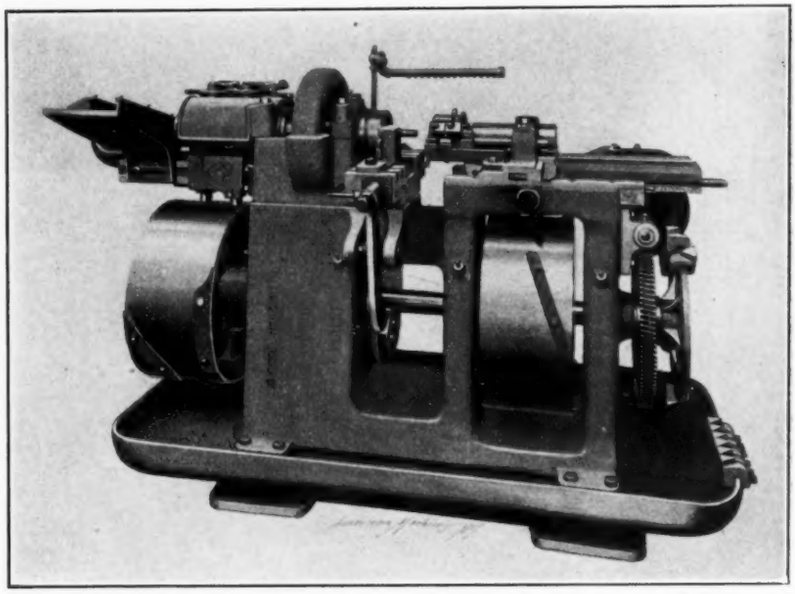


FIG. 22. "SLIDING TURRET," AUTOMATIC SCREW MACHINE WITH MAGAZINE.

As an example of the class of machinery manufactured in these works, Fig. 22 represents an automatic machine for the manufacture of studs. Instead of a rotating turret this is provided with what is termed a sliding turret carrying a die-head and a box tool. The studs are turned from rough bars, threaded, ended and cut off, and the machine is provided with a magazine for chucking the studs after they are cut off for threading the second end. The magazine is clearly shown in the photograph; it is fixed to the rear ends of the spindle and the studs are fed through the spindle from the back. Fig. 23 is a plan view of this machine. Essentially the same machine is of course made with a rotating turret and also without the mag-

azine. It will be noticed that the turret slide does not fit directly into the frame of the machine, but into a block which is fitted to the frame by scraping and can be adjusted forward or back, and clamped so as to give only the amount of overhang of the turret slide that is necessary for the job in hand.

Fig. 24 shows their No. 6 patent hexagon turret lathe with a complete outfit

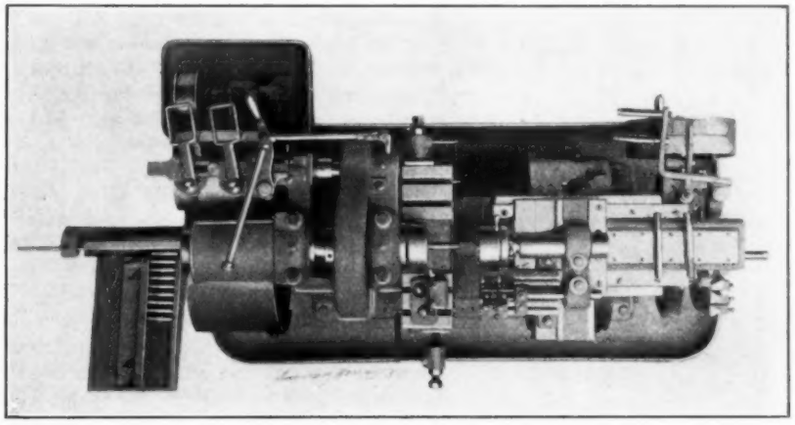


FIG. 23. TOP VIEW OF MACHINE SHOWN IN FIG. 22.

of tools for producing breech screws for 6-inch quick-fire guns. The photograph gives an excellent example of the tool equipments frequently fitted to lathes of this class.

Fig. 25 shows a vertical milling machine. It will be noted that all gears are fully enclosed and that all the operating handles are at the front of the machine in reach of the operator. The pull of the belt is taken by a fixed sleeve and does not come on the spindle. Automatic feeds and automatic stops are provided in either direction, and the circular table is fitted as an attachment, leaving the long table free when doing long work or when milling a number of pieces placed in a line.

Fig. 26 shows a large hexagon turret lathe admitting bars up to 3½ inches. This machine has numerous features of interest. By means of the friction clutch on the headstock six graduated speeds can be obtained at any time without shifting a belt and with the three steps on the cone pulley eighteen speeds are provided in all. The die-head will thread up to 3½ inches diameter, opens automatically, and can be set to take one or any number of cuts upon the work. It is guided by means of a lead screw and nut at the front of the bed, enabling accurate pitches to be cut. A power movement to the saddle is fitted in either direction by means of the lever shown on the front of the apron, and the turret when rotating is raised up from its seat upon a ball step bearing, enabling it to be spun round with the minimum of effort. The tool holders are very massive and are capable of taking the heaviest cuts, the cutting-off tool holder being arranged for carrying wide form tools. Each face of the turret has its own independent stop, these stops being fixed to the hexagon bar at the front of the lathe and in full view of the operator, and the feeds (of which there are eight) are changed by means of a lever.

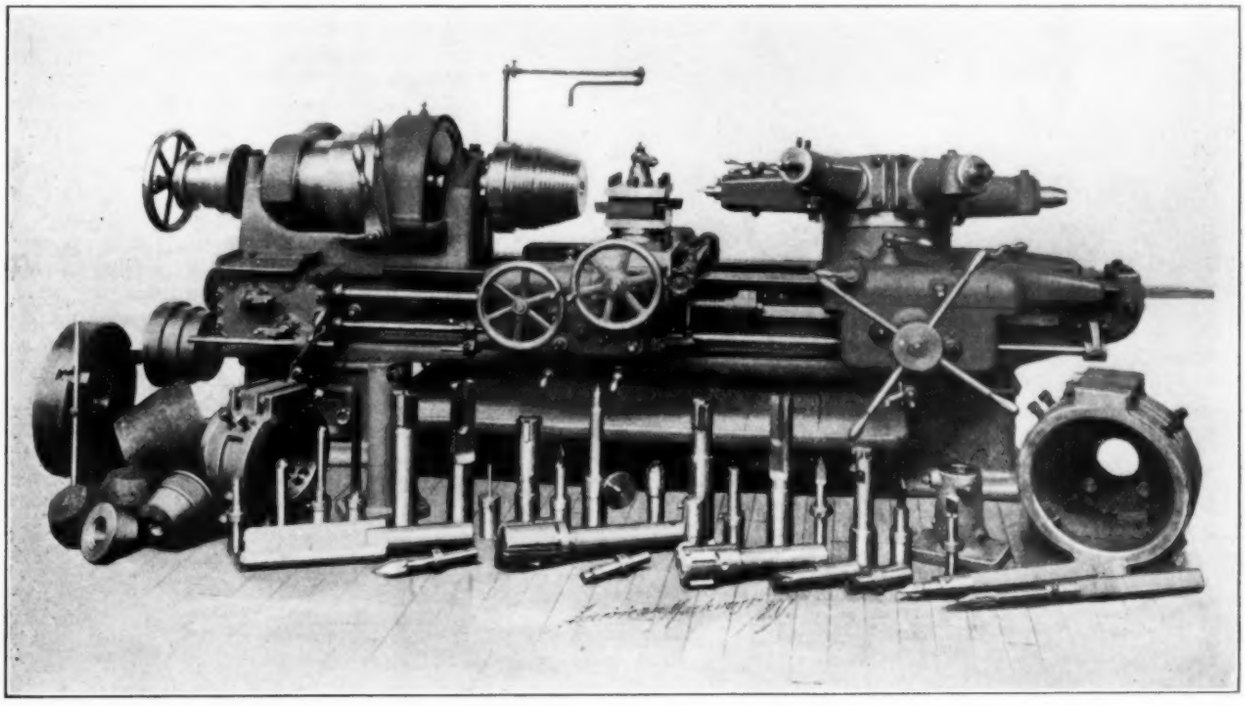


FIG. 24. HEXAGON TURRET MACHINE AND TOOLS FOR MAKING BREECH-BLOCKS FOR RAPID-FIRE GUNS.

Echoes From the Oil Country.

TESTS—HOME-MADE BABBITT METAL.

"That engine is in first-class shape and I will guarantee that it will do your work and run your mill right up to perfection. You will find it takes less steam and oil than the old one. Try it for three months, and if you are not suited I will take it out again. Very well, I will send it up in the morning and send a man to set it up and get it running."

You see, we had had that engine on hand for some time, and Brown might just as well have it for three months before we get our pay as to have it lie around; at least so I thought then. Johnnie set it up and stayed a couple of days to see that things were in proper shape. I went up several weeks after.

"Hello, Brown, how is the world using you, and how is the engine doing? Not very well? Is that so? Why, what is the trouble? Weak? That engine weak? Why, it is twice as strong as the old one. Well,

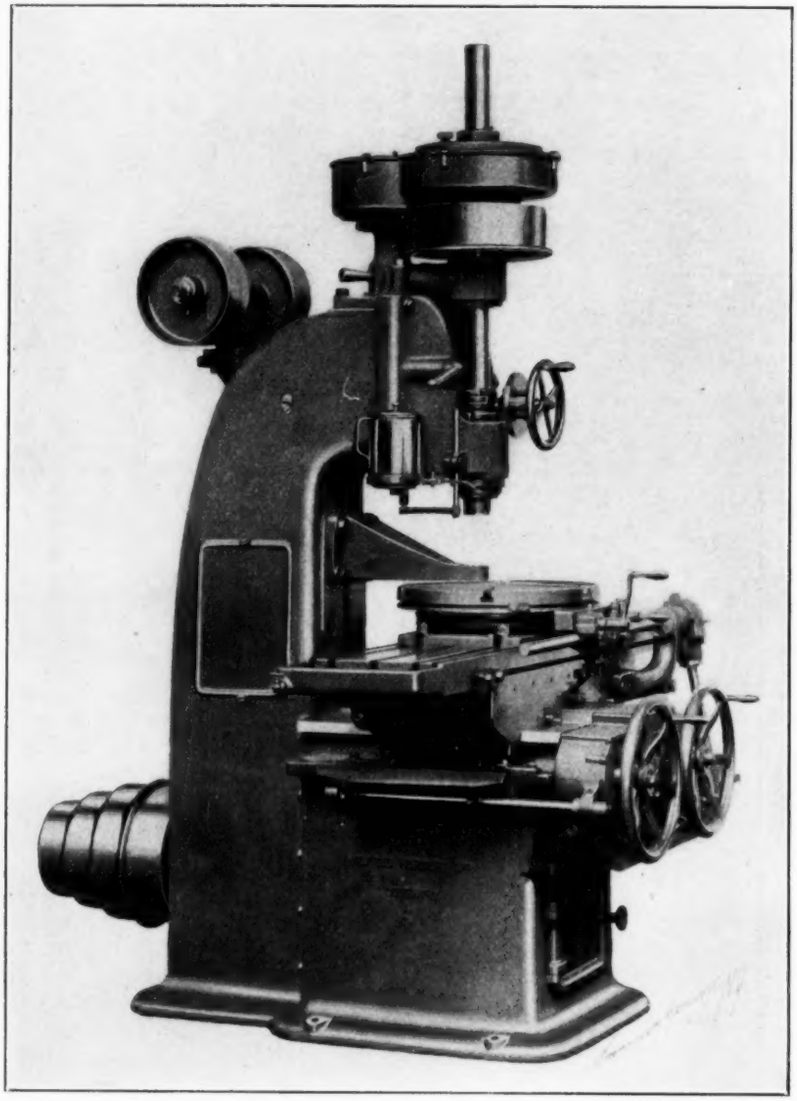


FIG. 25. VERTICAL MILLER.

go ahead and put on your work and let me see."

Brown could hardly find timber enough in this country to stock a mill as large as that engine would pull. I was more afraid he would complain of its being too big. What do you think he is doing now? The big saw and the slasher and edger are all running full jump, while the shingle saw and the jointer and planer are beginning to talk, and there goes the emery wheel on. Think of that for a test, will you? and in a place where they never saw shingles when they are running the big saw, and where the planer is not run six hours a week, and it takes the full crew to handle the stuff to keep it going as fast as it can when it is run.

I see one thing in my favor, though—that main belt is slipping and screeching and will be off in a minute unless something is thrown off to relieve it. Brown thinks lots of that belt, and is beginning to throw the work off again. Now, if he will only take a hoe and scrape some of the dirt off, and get some decent oil and put Harry back to run the engine instead of the blockhead he has, I guess things will be satisfactory. To make sure, I will see that Mr. Smith orders enough lumber for his rigs to more than cover the cost of the engine, and that will give us something in the way of knotty, sappy, shaky lumber to complain of if he finds fault with the engine. All I want is a fair show.

. . . . . .

"And so you are bringing the corn-sheller back, are you? Don't like it, and think it not any good, eh? Tested it and found it not satisfactory, and so return it? What kind of a test did you have that bent this handle and pushed this side out? A hemlock knot got mixed with the corn, and both of you were pulling, and your

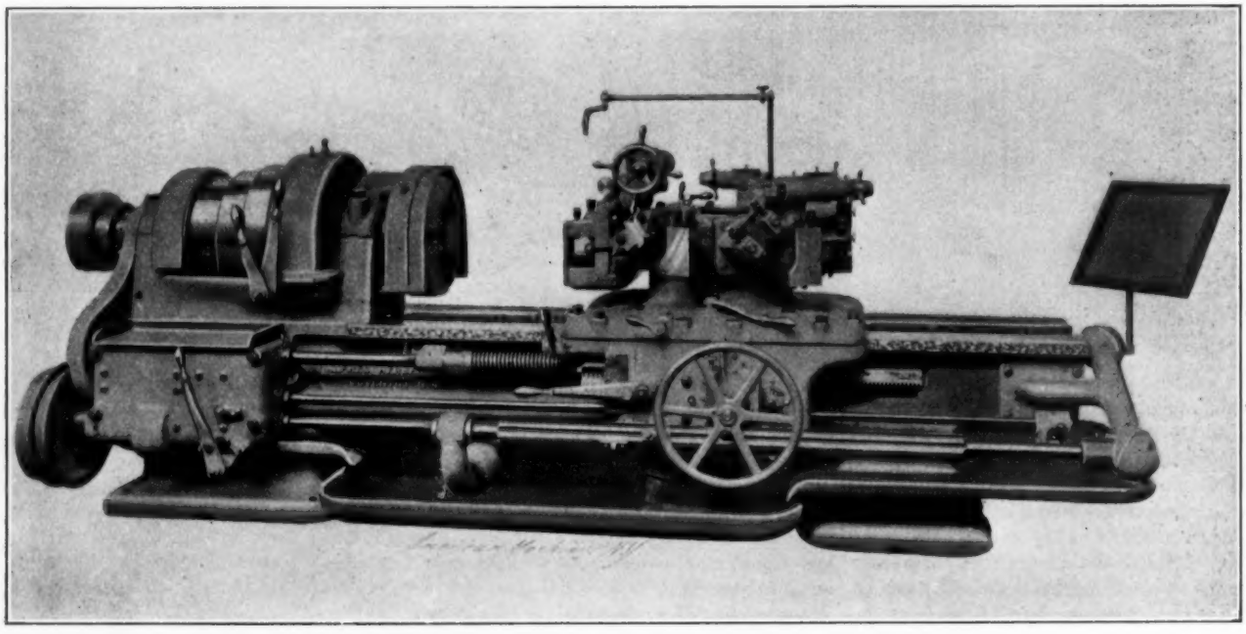


FIG. 26. LARGE TURRET MACHINE FOR BARS UP TO 3½ INCHES DIAMETER.

backs were so much stronger than your minds that you didn't stop to see what was the trouble. Now, I didn't make that thing to shell hemlock knots, and you can hardly blame me because your colt got loose in the barn and upset things and broke the hopper off. When I get it fixed you can come and get it, and I will send the bill for it, and for the repairs, to your father. You might kindly mind to test it the next time with a wedge and beetle, or try to use it as a stone crusher. A few drops of oil might keep it from squeaking some. I see you never used any yet. It will be ready for you day after to-morrow. Good day."

. . . . . .

Oh, yes! Here is a letter about that babbitt that came in the other day. "Took the liberty to send you [that's me] a sample lot of 100 pounds, which is guaranteed to do the work of the very best babbitt made; wish you would make test of the same, and if not entirely satisfactory in every way, return it at our expense." Well, I am ready to box that up and send it back, tested to my satisfaction. Its weight shows it is lead mostly. Dropping a piece shows it will break readily. Hammering some of it on the anvil makes the pieces fly in all directions. I might put some of it into a box, but that wouldn't tell me much. I put some of that junk babbitt into a box over at the mill when I first came to this vicinity, and it is there yet. They said three months was about the limit before, and they had been using a fancy metal with a big string of endorsements. Of course cut a good pocket for oil and put a cover on the oiler to keep the dirt out. Where the work is heavy or comes with a pound I use "genuine," and in most other cases any common metal will do. I believe if I were to babbitt a dozen boxes (this would hold good in two-thirds of the work in this section) all for the same work and of the same size, using a different brand for each box, and have them run under the same conditions, with plenty of oil, that there isn't an agent traveling selling marvelous metals who could pick his from the lot. If they were run with all sorts of neglect, lack of oil, lack of alinement, etc., I think the difference in their lasting powers would not puff up anyone.

Did you ever see a fellow get a fancy article of babbitt, melt it with care, pour it just right into a bearing easy to get at, see the bearing was properly scraped and lined, with ample oil grooves, watch that bearing that it always got oiled, and tell you of the wonderful qualities it possessed? Did you ever go around a year or so afterward and have another talk with him and find out whether it had displaced everything else? I have done both, and have enthused a little myself at times, but not so much now as formerly.

Some of these people believe all they say, every word of it and more. A bright young man, looking as though fresh from college, with winning address, came in, telling of the new steel just out (this was before the days of the Taylor-White process) that would revolutionize shop practice. Although very busy, I was tempted to listen. All that was wanted was an opportunity to demonstrate what this steel would do.

Out in the big lathe I could hear a pulley howling and screeching in that melodious way that indicated that the latheman was grinding his teeth and cursing the foundry in what little spare time he had left between grinding tools enough to keep going. He was trying to get a cut over with "Mushet" steel. Learning from the bright young man that his steel and Mushet's were really not in the same class, but that anything Mushet's would do would be play for his, I suggested a trial with the fine sample tool he had. To this he readily agreed.

The Mushet steel had been able to hold its own for about ½ inch of feed. Two revolutions of the lathe put his out of business. He was grit, though, and he said the temper was hardly high enough. All the facilities of the blacksmith shop were at his service, and he tempered it to suit himself while the other tool took up its noisy task. A half minute's work knocked the tool out again, and destroyed any remaining faith he may have had in the vastly superior qualities of his steel.

His idea of demonstrating the worth of his steel was a good one; for if he had been able to speed the lathe up a notch, put the next coarser feed on and then make that tool stand a cut clear across the face, nothing would have been too good for him; but his trouble was with his backing.

Mountains can be removed in a machine shop by faith as well as in other places; only before you try to demonstrate how strong it is, see that you have a good, strong fulcrum to rest it on and pry across. If you are not sure of the support, don't try, as I can tell you from personal experience that there are some things that bring more pleasant sensations than having demonstrations work the other way when you are trying to impress others with the magnitude of your attainments. It is much better to practice without too many spectators. In the case of the steel, the demonstration was very direct and plain. Unfortunately, some things cannot be brought to a conclusion nearly so quickly or with such certainty.

I don't believe a babbitt metal could be made so poor that some people could not be found who would be able to honestly tell that it had done their work in fine shape, and no doubt the parties our friends mention in the "American Machinist" occasionally, as having some mis-shipped oil on hand at a nearby station, can produce testimonials showing it is a very fine oil indeed. The great trouble is to know just what the conditions are under which it is used.

"Sammy, take this metal and try it in our emery wheel frame; this is claimed to be the very thing for hard work and lots of it. Mr. Smith brought a few pounds from Pittsburgh for us to try. Heat it in a clean ladle, get a handful of plumbago facing from Ben in the foundry to keep it covered while melting. Put a good big gate on each box and have a hole in each end to let the air out, and don't forget to pour quickly. I don't think it should be necessary to warm either the box or shaft; we never did it before."

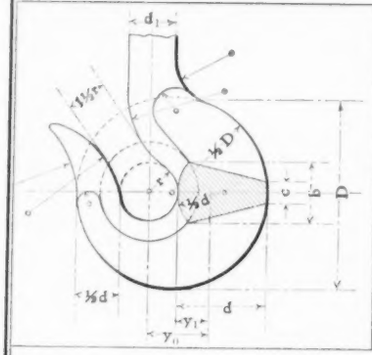
You see this is a new one, and I want a chance to not babbitt the emery wheel again for several years. It runs almost constantly and only lasts about two or three years now.

Sammy did as I told him and the metal ran nearly half around the shaft. After digging it out and heating the boxes with a hose and gas, and making the shaft as hot as we could handle, and pouring from both sides and patching up a few places, we got two boxes that would do for ourselves. They are worn out now and genuine babbitt is doing the work. I don't know how long they lasted, but I can recommend that babbitt as excellent for use in place of copper to hammer on. Life was too short to try to pour it in our boxes. I made one more trial, using sal-ammoniac as a flux, but could see no virtues to tempt me. If my work required a metal that would stand tons per square inch I would try still further; but it doesn't, and dust-proof, self-oiling boxes will do for anything in my line, with good standard goods for lining.

W. Osborne.

A Tool-Hardening Compound.

A United States patent has recently issued for the following composition for "tempering tool-points": Carbonate of ammonia, 6 ounces; carbonate of potassium, 6 ounces; nitrate of potash, 6 ounces; soap, 4 ounces; soft water, 15 gallons. The ingredients are to be thoroughly "mixed by agitation." The specification says: "In utilizing the above composition for hardening the points of tools, the tools to be hardened are, as fast as the same are completed, and while still at a red heat, successively so arranged or supported above a vessel containing the liquid solution as to cause the points only of said tools to extend into the solution. The tools are thus left until the points are sufficiently cooled and hardened." The description of the operation is absurd and impracticable. The tools, of course, if the compound is of any value, are to be heated to the right color and the parts to be hardened dipped into the solution until sufficiently cooled to retain the hardening. The specification assures us that "it has been demonstrated that the particular composition or solution herein set forth is exceedingly effective in imparting the desired temper to tool-points."



$$\frac{P}{f} = \frac{S}{1 + \frac{y_0\, y_1}{R^2}} \quad \text{General Formula}$$

$$S = \frac{b+c}{2} \times d \quad 1. \qquad y_1 = \frac{b+2c}{b+c} \times \frac{d}{3} \quad 3.$$

$$R^2 = \frac{d^2(b^2+4bc+c^2)}{18(b^2+2bc+c^2)} \quad 2. \qquad y_0 = \left(\frac{b+2c}{b+c} \times \frac{d}{3}\right) + r \quad 4.$$

Assuming $b = .656\,d$; $c = .22\,d$,

We have:- $$\frac{P}{f} = \frac{d^3}{7.79\,d + 11.313\,r} = K \quad 5.$$

$d_1 = 0.5\,d.$ $D = 2r + 1.5\,d$

DIRECTIONS.

P and f being known, assume r to suit the requirements for which the hook is to be designed. Divide P by f and find the quotient in the column headed by the required r. At the side of the table, in the same row, will be found the necessary depth of section, d.

NOTATION.

P = Load. S = Area of section.
R^2 = Square of the radius of gyration.
f = Allowable fiber strain in pounds per square inch

Values of K.

d.	r.																				
	.50	.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	5.00	5.50	6.00
2.00	.378	.335	.300	.271	.248	.228	.212	.197	.184	.173	.164									
2.25	.493	.440	.397	.362	.333	.308	.286	.267	.251	.237	.224									
2.50	.624	.562	.511	.468	.432	.401	.375	.352	.330	.312	.296	.281								
2.75	.771	.698	.639	.589	.546	.509	.477	.448	.423	.400	.380	.361								
3.00	.934	.851	.783	.725	.675	.631	.592	.558	.528	.501	.477	.454	.433							
3.25	1.112	1.019	.941	.875	.818	.767	.722	.682	.646	.614	.585	.559	.535							
3.50	1.306	1.204	1.117	1.042	.975	.918	.867	.820	.778	.742	.707	.677	.648	.622						
3.75	1.517	1.404	1.307	1.223	1.149	1.084	1.025	.973	.926	.882	.843	.808	.774	.744						
4.00	1.743	1.620	1.514	1.421	1.338	1.265	1.199	1.139	1.086	1.037	.993	.950	.913	.879	.846					
4.25	1.985	1.852	1.736	1.633	1.544	1.461	1.387	1.321	1.261	1.206	1.155	1.109	1.066	1.026	.989					
4.50	2.244	2.100	1.974	1.862	1.762	1.672	1.591	1.517	1.450	1.389	1.333	1.280	1.232	1.188	1.146	1.108				
4.75	2.519	2.364	2.228	2.107	1.997	1.899	1.810	1.729	1.655	1.587	1.524	1.466	1.412	1.363	1.316	1.273				
5.00	2.808	2.643	2.497	2.363	2.247	2.140	2.043	1.955	1.873	1.798	1.725	1.665	1.606	1.551	1.499	1.450	1.405			
5.25	3.115	2.939	2.782	2.641	2.513	2.398	2.292	2.196	2.107	2.025	1.994	1.879	1.856	1.752	1.695	1.642	1.592			
5.50	3.438	3.251	3.084	2.933	2.796	2.671	2.557	2.452	2.356	2.267	2.184	2.107	2.036	1.969	1.906	1.874	1.792	1.740		
5.75		3.578	3.400	3.240	2.093	2.959	2.836	2.723	2.619	2.523	2.433	2.350	2.272	2.198	2.130	2.066	2.005	1.948		
6.00		3.922	3.734	3.563	3.406	3.263	3.132	3.011	2.899	2.794	2.697	2.607	2.522	2.443	2.369	2.299	2.233	2.170	2.111	
6.25		4.281	4.082	3.901	3.735	3.582	3.442	3.313	3.192	3.080	2.976	2.878	2.787	2.701	2.621	2.545	2.473	2.405	2.340	
6.50		4.656	4.447	4.255	4.080	3.918	3.769	3.630	3.512	3.382	3.270	3.165	3.067	2.975	2.888	2.806	2.730	2.656	2.586	2.519
6.75		5.048	4.827	4.626	4.441	4.269	4.110	3.963	3.826	3.699	3.579	3.467	3.361	3.262	3.169	3.081	2.997	2.917	2.845	2.773
7.00		5.456	5.227	5.012	4.817	4.636	4.468	4.313	4.264	4.031	3.903	3.784	3.671	3.565	3.465	3.369	3.282	3.197	3.115	3.038
7.25		5.880	5.638	5.416	5.210	5.019	4.843	4.677	4.523	4.378	4.243	4.116	3.996	3.883	3.777	3.675	3.578	3.487	3.403	3.320
7.50			6.067	5.834	5.618	5.418	5.243	5.067	4.894	4.741	4.598	4.463	4.335	4.215	4.100	3.992	3.892	3.794	3.701	3.612
7.75			6.511	6.269	6.042	5.832	5.636	5.452	5.280	5.119	4.967	4.824	4.689	4.564	4.442	4.326	4.217	4.112	3.982	3.922
8.00			6.973	6.718	6.482	6.262	6.056	5.864	5.553	5.513	5.352	5.201	5.059	4.923	4.794	4.672	4.559	4.448	4.343	4.242
8.25			7.449	7.184	6.937	6.707	6.492	6.200	6.100	5.921	5.753	5.593	5.441	5.302	5.166	5.036	4.912	4.795	4.687	4.580
8.50			7.941	7.666	7.409	7.169	6.944	6.732	6.533	6.345	6.169	6.003	5.843	5.691	5.547	5.415	5.285	5.161	5.042	4.929
8.75			8.450	8.165	7.897	7.647	7.411	7.190	6.982	6.786	6.600	6.423	6.255	6.101	5.949	5.805	5.668	5.541	5.416	5.296
9.00			8.976	8.697	8.401	8.140	7.895	7.665	7.447	7.239	7.050	6.854	6.688	6.521	6.361	6.215	6.070	5.932	5.800	5.673
9.25				9.209	8.920	8.649	8.395	8.155	7.927	7.714	7.510	7.315	7.131	6.961	6.794	6.635	6.482	6.342	6.203	6.070
9.50				9.754	9.455	9.175	8.910	8.660	8.422	8.197	7.991	7.787	7.594	7.411	7.235	7.074	6.915	6.762	6.616	6.481
9.75				10.32	10.01	9.716	9.441	9.177	8.938	8.703	8.480	8.268	8.093	7.882	7.698	7.524	7.356	7.202	7.049	6.907
10.00				10.89	10.57	10.27	9.990	9.718	9.461	9.217	8.993	8.772	8.562	8.361	8.170	7.994	7 819	7.651	7.491	7.342
10.25				11.23	10.90	10.60	10.31	10.03	9.782	9.533	9.298	9.073	8.867	8.662	8.467	8.281	8.102	7.937	7.773	7.616
10.50				12.10	11.76	11.44	11.13	10.84	10.57	10.30	10.06	9.822	9.594	9.377	9.176	8.977	8.786	8.603	8.428	8.266
10.75				12.72	12.37	12.03	11.72	11.45	11.14	10.87	10.61	10.36	10.13	9.904	9.688	9.481	9.282	9.099	8.916	8.740
11.00					13.00	12.66	12.34	12.02	11.73	11.44	11.19	10.93	10.68	10.45	10.23	10.02	9.809	9.610	9.420	9.243
11.25					13.52	13.17	12.84	12.54	12.23	11.95	11.67	11.41	11.17	10.93	10.70	10.48	10.28	10.07	9.875	9.687
11.50					14.18	13.83	13.48	13.16	12.85	12.56	12.28	12.00	11.75	11.50	11.27	11.04	10.82	10.61	10.43	10.21
11.75					14.85	14.48	14.16	13.80	13.48	13.18	12.88	12.60	12.34	12.09	11.84	11.60	11.38	11.17	10.95	10.75
12.00					15.55	15.17	14.81	14.46	14.13	13.83	13.52	13.23	12.95	12.69	12.44	12.19	11.96	11.73	11.52	11.31
12.25					16.25	15.86	15.48	15.14	14.80	14.47	14.16	13.87	13.58	13.31	13.04	12.79	12.56	12.32	12.09	11.87
12.50					16.98	16.58	16.19	15.83	15.48	15.15	14.83	14.52	14.22	13.95	13.68	13.41	13.16	12.92	12.69	12.46
12.75						17.30	16.92	16.55	16.18	15.84	15.50	15.20	14.89	14.60	14.32	14.04	13.79	13.54	13.30	13.06
13.00						18.05	17.65	17.26	16.89	16.54	16.20	15.87	15.56	15.27	14.98	14.70	14.43	14.17	13.92	13.68
13.25						18.80	18.40	18.00	17.62	17.25	16.90	16.58	16.25	15.94	15.64	15.36	15.08	14.81	14.56	14.31
13.50						19.59	19.16	18.75	18.37	18.00	17.63	17.29	16.95	16.64	16.34	16.04	15.75	15.48	15.21	14.95
13.75						20.38	19.95	19.53	19.13	18.75	18.37	18.03	17.69	17.36	17.04	16.74	16.45	16.16	15.88	15.62
14.00						21.19	20.74	20.31	19.91	19.52	19.14	18.77	18.42	18.09	17.76	17.44	17.14	16.86	16.57	16.29
14.25						22.01	21.57	21.12	20.70	20.29	19.92	19.54	19.18	18.83	18.49	18.18	17.86	17.56	17.27	16.98
14.50							22.30	21.94	21.52	21.10	20.70	20.31	19.94	19.59	19.25	18.91	18.59	18.29	17.99	17.70
14.75							23.24	22.78	22.33	21.90	21.50	21.11	20.73	20.36	20.01	19.68	19.34	19.02	18.71	18.42
15.00							24.09	23.62	23.18	22.74	22.32	21.92	21.54	21.16	20.79	20.44	20.06	19.78	19.46	19.15
15.25							24.98	24.49	24.03	23.58	23.17	22.75	22.35	21.96	21.59	21.24	20.89	20.55	20.22	19.92
15.50							25.86	25.39	24.91	24.45	24.01	23.58	23.19	22.79	22.41	22.04	21.68	21.34	21.00	20.68
15.75							26.78	26.27	25.79	25.32	24.89	24.45	24.03	23.62	23.24	22.86	22.49	22.13	21.79	21.47
16.00							27.69	27.20	26.70	26.22	25.76	25.32	24.90	24.48	24.08	23.69	23.33	22.96	22.60	22.26

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Crane Hooks.

BY A. E. HOLCOMB.

Engineering hand books and treatises on machine design give a few empirical formulas for the design of crane hooks, which they are careful to state are correct only up to a capacity of 10 tons. In the present era of engineering progress, hooks with a capacity of 100 tons or more are required, and the designer must as a consequence make a guess as to the right proportions for a hook above the 10-ton limit.

Almost the only data obtainable for hooks of large size were given by Mr. C. F. Blake in his compilation of formulas for different sections eccentrically loaded in the "American Machinist" No. 24, 1900, [important errors corrected in No. 28.—Ed.].

After a careful study of the variation of the strength with variations of the form of the section most commonly used, and shown in the accompanying table, it was found that the following assumptions, $b = 0.656\,d$ and $c = 0.22\,d$, give the best cross section for a hook. The table has been worked out from a combination of these assumptions with the formulas given in the table compiled by Mr. Blake, and is good for hooks varying in capacity from 1 to 100 tons.

The Reuleaux formula is given for finding the diameter D of the outside of the hook. This formula takes care that the section at the bottom of the hook is strong enough to hold the load in shear.

The designer must use his own judgment in the selection of the allowable fiber strain f for the material being used. The following example will best illustrate the use of the table:

It is required to design a 30-ton hook of hammered steel, the hook to have an opening of 4½ inches.

Assuming a safe fiber strain of 15,000 pounds,

$$k = \frac{60{,}000}{15{,}000} = 4$$

The half opening of the hook $r = 2\frac{1}{4}$ inches. Running down this column until the nearest value to 4 is found, which is 3.963, and across to the column headed d at the left side of the table, we find that 6¾ is the length of the section required. Then

$b = 0.656 \times 6.75 = 4.43 = 4\ 7\text{-}16$ inches and

$c = 0.22 \times 6.75 = 1.49 = 1\frac{1}{2}$ inches.

The outside diameter of the hook is:

$D = 2 \times 2\frac{1}{4} + 1\frac{1}{2} \times 6\frac{3}{4} = 14\frac{5}{8}$ inches.

The diameter of the neck is:

$d = 0.5 \times 6\frac{3}{4} = 3.375 = 3\frac{3}{8}$ inches.

The Billion Dollar Steel Trust has been regarded as rather a large concern, but it is going to be left away behind by the International Construction and Development Company, which is said to be applying for a charter in Arizona with a capital stock of $10,000,000,000. The avowed objects of the company embrace everything.

A Gang Die and Its Work.

BY WILLIAM DORAN.

For the production of small sheet metal articles which are required to be pierced, bent and formed at one or more points, the dies used should be—whenever possible—of the gang type, as only by the use of such dies can it be carried on at a profit. All too frequently dies of the plain type are used, and three or more dies are required where the same results could be accomplished in one operation. Where sheet-metal parts are required in large and steady quantities, an operation saved in their production means a great deal, and if two operations can be saved, even at the outlay of considerable money and time, the results attained will more than pay for all.

As an illustration of what can be accomplished by the use of a gang die of comparatively simple design and inexpensive construction, we show here a punch and die adaptable for the production of a large variety of pierced and formed articles. The product of this die is shown in two views in Fig. 1. It is punched from hard sheet brass, with a central hole pierced at *a*, four pear-shaped holes *b* and the ends *c* split and bent downward as shown. Three operations are required, but as they are all combined in the one die there is practically only one operation, producing one complete piece at each stroke of the press.

The two lower illustrations in Fig. 5 are a plan and vertical section of the die. The stock used for the die was of the composite iron and steel kind, which I have found to give the best results, especially in dies where there are two or more portions worked away, and which are irregular in shape, as when hardening the tendency to shrink or warp excessively is eliminated. *E E E E* are the four pear-shaped

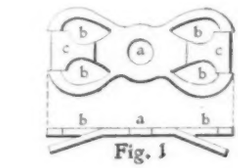

Fig. 1

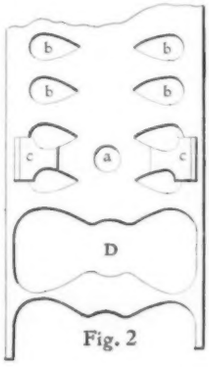

Fig. 2

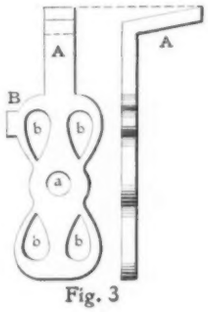

Fig. 3

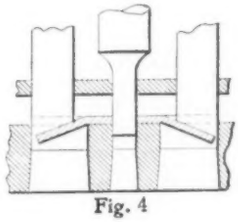
Fig. 4

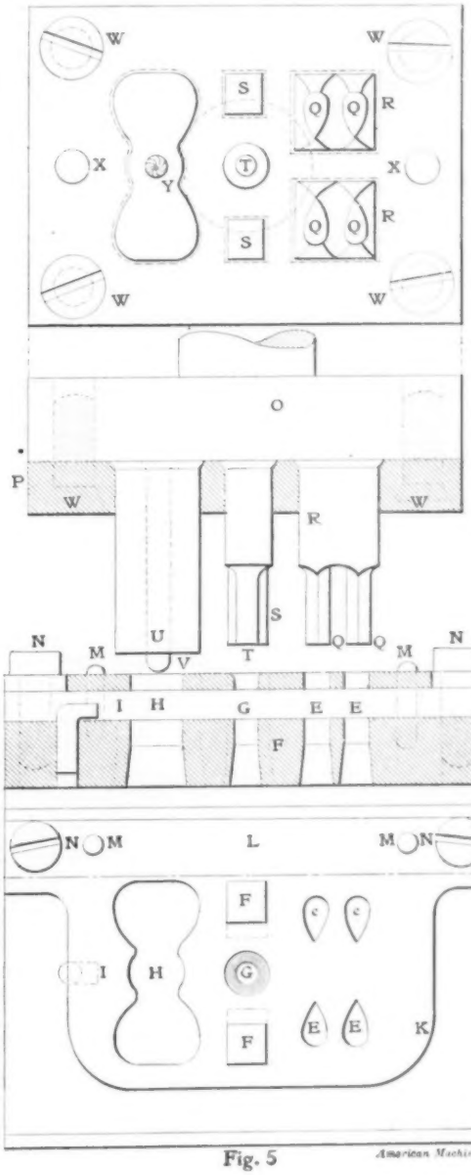

Fig. 5

American Machinist

A GANG DIE AND ITS WORK.

piercing dies, *F F* the splitting and bending dies, and *G* the round piercing die, while *H* is the blanking die. All of the dies are worked out perfectly straight for about 5-16 inch in depth, and then tapered away for clearance.

While explaining the construction of the die, a few remarks as to the best method of laying out to insure accurate location may not be amiss. In the first place finish the templet Fig. 3, to the exact size and shape required, with all pierced holes to size and in exact position, only leaving two points on the outer edges of the blank unfinished. These points are for locating the outlines of the different operations square with the side of the die and in line with each other, and also to get exactly the same amount of space between the different operations or the same amount of scrap between the blanks, as if this is not done accurately the locating of the stop-pin is impossible. The unfinished points on the templet, Fig. 3, are at *A* and *B* respectively, the part *A* being bent and finished to allow of resting it against the taper planed side of the die, and the edge of *B* finished to project from the side of the templet the same distance as the amount of metal to be left between the blanks.

We grind the face of the die, bluestone it and locate the templet on it for the first outline *H*, which is the blanking die, holding the part *A* against the side of the die and clamping the templet to the face with a die-maker's clamp and then with a sharp scriber transfer the outline of the blank to the die. This done we move the templet along until the edge of *B* is in line with the outline of the opposite side, clamp it in position and with a sharp center drill, which should fit nicely in the hole *a*, drill the center for the piercing die *G* and transfer the outline of the blank as before. We move the templet once more, relocating the edge of *B* and scribe the outlines of the four pear-shaped dies *E E E E*. The templet is now removed. Now drill and ream the hole for the piercing die *G*, lay out the two splitting and bending dies *F F* from the center of *G* and from the sides of the blank outline. We remove the projecting parts *A* and *B*, so that the templet is perfect. The die can now be finished in the usual manner, first the blanking die, working to lines, and letting the templet through it, then the splitting dies *F F* and lastly the pear-shaped dies *E*. After drilling the holes for the screws *N N* and the gage and stripper plate dowels *M M*, and also that for the stop-pin *I*, the die should be hardened.

The upper two views of Fig. 5 show a plan and section of the punch, with all punches let into a machine steel pad and upset or riveted on the back, as shown. *O* is the stem or holder, of cast iron, *P* the punch pad, of machine steel, which is fastened to the holder face by the four screws *W* and located by the dowel pins *X*. *U* is the blanking punch, with the pilot pin *V* let into the center, *S S* the splitting and bending punches, *T* the round piercing punch and *Q Q Q Q* the four pear-shaped piercing punches. The locating and finishing of the pilot pin-hole in the punch is accomplished by soldering the templet to the face of the blanking punch while it is in the rough, transferring the hole through it, and then working the punch down to the edges of the templet. The only punches hardened were the two *S S* and they were drawn to a dark-blue. In Fig. 2 is shown a section of the stock used. The stock is fed in so as to project slightly over the edge of the blanking die *H*, and as the punch descends the end is trimmed and the other holes are punched. At the next stroke the blank produced is useless, as it is incomplete, but after that a perfect blank of the shape shown in Fig. 1, and with the ends *c c* split and bent to the angle shown, is produced at each stroke. The manner of splitting and bending the ends is shown in Fig. 4. As shown in the sectional view of the punch, Fig. 5, the blanking punch is considerably longer than the others. This is done so that the blank will have been located and punched out before the other punches start to cut, thus insuring the accurate locating of the stock. This leaving the blanking punch longer, I have found practical for all dies of this class, as it not only makes the punching of the stock progressive, but holds and locates it positively. When the piercing and blanking punches require grinding, which shortens them, to accommodate the two splitting and bending punches *S S* to them the pad *P* is removed, the punches *S S* are driven partly out and filed off at the back the required amount, then driven back and re-riveted as before, this being possible as the backs are left soft.

Letters from Practical Men

Tube Forming Dies.

Editor American Machinist:

I notice on page 1133 that Mr. B. J. Dougherty, in describing certain tube-forming processes and the tools used, says: "There is still another way of forming *parallel* tubes only in which the mandrel is dispensed with, but on work where the stock is heavy only, say about 16 or 14 gage."

As the method to which he refers was patented by me, I presume I may speak with authority in regard to the process and its limitations, and to correct his statement in certain particulars.

My first machine was made with automatic motions for handling the blanks, and made a taper tube from common IC tin in very great numbers. At that time wick tubes for oil lamps were all made by folding a blank of tin about a mandrel, and the tubes were soldered, usually in pairs, into the lamp top, leaving a quantity of solder about the joint to reinforce and strengthen it. The new process made tubes with butted—not lapped—edges, and they were securely fastened into the lamp top by forming two small beads, one above and one below the plate of the metal top, by means of a punch and die, the punch being made to fit down upon a pair of tubes that were held in position in a clamping die, so that end pressure crimped the tubes to form the beads and then compressed the beads and the plate solidly together.

The new process was cheaper, stronger and much neater, so that it quickly superseded the old way. I think it would be difficult to find one of the old kind of tubes at this time.

I also made a variety of other tubes, both straight and tapered, as for candlestick barrels, umbrella ferules, oil-can nozzles, etc. I found no reason in most cases why the metal should be thick in order to make a tube, although in many cases they were air and water-tight when they left the dies. Neither is there any reason, if the dies are correctly made and the press stiff, why there should be a mark showing where the dies came together; or, rather, where they failed to come together.

I made about the same time and patented a machine for bending such tubes without a mandrel, and I have at this time a variety of tubes of tin and brass which are bent into curves of various sizes upon this machine. This is a far more difficult thing than to form the tube, although the principles of the dies are somewhat analogous. One of these tubes, made in several sizes, was for the well-known curved oil-can nozzle. These tubes were made from a good quality of IC or IX tin, with a butted joint along the concave side of the bent end. They were usually air and water tight before bending and were finished by retinning. The dies were of course made with great care, particularly for bending. All of the dies shown in Figs. 1, 2 and 3 of the article referred to are of well-known forms, and if correctly made will, I am sure, work as well without the mandrel as with it.

Moses G. Wilder.

413 Walnut St., Philadelphia.

The Allis Engines at Glasgow.

Editor American Machinist:

It falls as a duty to me to confute your publication as regards the Allis engines in Pinkston. I am a Swiss, and, having no prejudice, I class the Allis engine as third. My reasons are: They vibrate in a dangerous manner when moving about 10 revolutions per minute. The Musgrave engines are the finest I have seen in a power station, and as regards easy access to all parts, they are perfect. This cannot be said of the Allis engines. The Stewart engines are typical Glasgow engines, a good job and very durable. I am told that when the Allis engines stopped with a city full of cars—about 2,500 horse-power, approx-

imately—the Stewart engines took the load, being 700 horse-power above what they were constructed for. You say the Allis engines are ahead of the others, but I advise you to believe no special man, but visit the station, as I have done, and speak according to your knowledge.

Ten locomotives built by Messrs. Nelson & Reid, of Glasgow, were tried against the same number of American Baldwin engines, the dimensions of cylinders and wheels being alike. The results were greatly in favor of the Scotch engine, which drew 555 tons 130 miles on 2 tons 14 cwt. of coal, at a steam pressure of 140 pounds per square inch. The American engine drew 443 tons 130 miles on 4 tons of coal, at a pressure of 160 pounds per square inch.

What I want to demonstrate to you is your awful one-sidedness in all your statements, which will not gain you markets or respect, and with a little reflection you will come to my way of thinking. I like your articles, all but your extreme one-sidedness. I showed the article on the Allis engines, in your issue No. 33, to the chief on duty, and he said the statement was entirely inaccurate and he wished to know what magazine published such stuff.

CHARLES BERTHIER.

Airdrie, Scotland.

Varnishing Patterns.

Editor American Machinist:

Varnishing patterns, as "Patternmaker" tells us on page 1144, is an artistic performance little understood by many members of the fraternity of patternmakers. After advancing three reasons why patterns should be shellacked he omits the most important of all—that of water-proofing the pattern by applying one, two or three coats of varnish, which should be the only reason for using valuable time to give a neat and finished appearance to the pattern that will endure only until the molder lays hold of it. Very often after one mold has been made the neat and finished appearance has vanished, never to return; therefore why waste time striving for artistic effect that is so short lived? Why not smear and daub the varnish on the places where it will do the most good? And why should a patternmaker do any varnishing, anyhow, or sandpapering, for that matter? Can "Patternmaker" tell me? If not, tell him that in up-to-date shops there is a varnishing room partitioned off from the main shop, where the dust particles are not quite as numerous and where varnishing is comparatively easy and is accomplished, not by patternmakers at 35 cents an hour, but by men who sandpaper and varnish *only*, and who are glad to get 25 cents an hour for their work.

The time is passing when a patternmaker can spend unlimited time titivating his job with a useless layout in black on the joint of the pattern (if it has one) or dotted lines on the outside for the same imaginary reason, or by the hundred and one little tricks that the Meissonier of the pattern shop was wont to kill time with. The bosses have acquired wisdom at last, and in shops that would be considered unimportant they work the "cub" on the varnishing, and it's plenty good enough at that.

Wherever the molder is apt to use his "swab," that's the place to put the extra varnish; sometimes on the joint of the pattern, around the edge, or around the cope edge, if the pattern is not parted.

Black varnish may cover a multitude of sins, plus "putty dutchmen," but anybody conversant with foundry practice knows that it's the real thing for patterns. If an artistic effect is really desired, paint the prints red, the loose pieces green, with a few stripes here and there to confuse the molder.

OLD BOB.

Editor American Machinist:

I would like to say a little about varnishing patterns. "Patternmaker's" main idea (page 1144) in advocating yellow varnish for patterns is on account of the looks of the patterns when finished. I would like to tell our practice in a modern shop where we employ forty patternmakers.

We varnish patterns in three distinct ways: First, all patterns for iron castings are varnished red, with black core-prints; second, all patterns for steel castings are varnished black, with red core-prints; third, all patterns for brass castings are varnished yellow, with black core-prints. This allows the pattern storage man, the minute he lays his hand on the pattern with the number he is looking for, to know which foundry it goes to; or, if a pattern is returned to the pattern shop to be altered or repaired, the patternmaker knows at once what shrinkage has been allowed on it.

CHAS. REYNER.

"Wasted Labor."

Editor American Machinist:

On pages 1080-81, Mr. Tecumseh Swift has a letter about turning those granite columns for the Cathedral of St. John the Divine, and he says that some mechanic ought to make a bid to do the job. He says "there's money in it." Now, I doubt it. I have actually written to that quarry firm like this: "Dear Sirs: There is an article in one of the Philadelphia papers about your broken granite pillars. It tells us that your firm has abandoned the idea of turning the 54-foot columns out of one solid piece of stone, and that you intend to make those columns out of two pieces. This looks as if there were no mechanics living in the United States. Of course, the best man is liable to make mistakes. The way you tried to turn those columns might well be used in turning a stone as long as 18 or 20 feet, but when it gets any longer it's a risky undertaking. The job is an easy thing to do by a little change of your method. Any granite pillar, be it a hundred feet high, can be turned and polished into any shape and form you desire to give it, and I am able to do it and to do it in an easy way and so that you will run no risk whatever of breaking the stone. The change that will have to be made on your machinery won't cost you much. If you should like to communicate with me about it, my address is ——."

I have not received an answer to my letter.

Now, I would not like to turn a 50-foot stone column the way Mr. Swift proposes to do it. I have my own experience in this kind of work, and I know how to do this job, and I know how to do it without running any risk of breaking the stone, as I have stated in my letter to the granite company. If there is money in it, there will be money in it for Mr. Swift if he will kindly lend me a hand in getting the job. I am able to prove that I am able to do the job.

Mr. Editor, will you please hand this letter to Mr. Swift? I am in need of a little money and I will be glad to earn it.

M. VICK.

Editor American Machinist:

I notice the article by Mr. Tecumseh Swift, on page 1080, about "Wasted Labor" in the case of the granite lathe. The result is what I expected when I saw a cut of it, with a description of it, and what it was to do and how it was to do it. In the first place, the weight of the columns is so great that it is a difficult matter to swing them in bearings. If I had that job I would not use either a headstock or footstock. Instead of them I would use a headplate to take the end thrust, and steady-rests to support the column and hold it from turning. I would use one carriage, of sufficient length to provide ample support for a hollow cylinder large enough to freely encircle the rough column, the cylinder to rotate and carry suitable cutters for turning off the stone. The cylinder should be driven by suitable gearing and the carriage fed along by screws at each side, geared together to divide the pull. By this means I believe those columns can be turned and polished without breaking. It is a discredit to us progressive Americans to have the job given up as it is.

PAINE BRIES.

Des Moines, Iowa.

Editor American Machinist:

Mr. Vick's letter to the quarry company seems to be in itself another touching instance of "wasted labor." Probably the company has received several or more letters of the same general purport, and it is not to be wondered at that they did not take the trouble to answer them, especially if, as in this case, the writers told nothing of how they purposed to do the job. For the same reason, if not for several others, Mr. Vick has wasted his labor

in trying to secure my assistance for his scheme, whatever it may be.

Of course, there are a great many ways that might be suggested for turning those columns without breaking them. If the stone was to be rotated it might be stood up on end and be machined in that position without risk of breakage, but the operation and apparatus would be expensive. The tendency of modern practice in machining heavy masses of iron or steel would point inevitably to the suggestion that the cutting tools should move instead of the stone. Mr. Vick offers no hint of how he would do it.

Now, I may as well say frankly that from my experience with those fellows who are so afraid that somebody is going to steal their ideas—and I've had lots of such experience—I have come to the general presumption that their ideas are not worth the trouble they take to guard them. It is the man of few and small mechanical ideas, rather than those who have many and broad ones, who guard them so jealously. If Mr. Vick, or any other inventor, has a novel and original and patentable idea, the best way to make indisputable the ownership of it is to make it public as soon and as widely as possible. If he has any kind of an idea of value as to the way to machine the stones he would certainly have to reveal it after a lot of talk or correspondence, so why not before? The job, as I look at it, is not one that requires any new or scarce kind of ability, unless common sense is a scarcity. TECUMSEH SWIFT.

Information Wanted—Standards in the Drafting Room.

Editor American Machinist:

On page 1082 "Perseverance" gives us a good scheme for having our standards handy, by pasting them on the back of the T-square. This is very good as far as it goes, but in the case I have in mind I fear there would be so many standards that the T-square blade would not be large enough to hold them all, so I reckon the idea of a man I worked under some years ago comes nearer to the mark. His idea or hobby was to have the walls of the drawing-room decorated with standards of all kinds, in fairly good size letters and figures, so that they could be seen easily from any part of the room, to save the draftsman's time in hunting the necessary information. He also advocated a vertical scale of feet and inches on the wall, to give one an idea of hight.

Now, these ideas may be somewhat extreme, but it does seem to me that it would be a good investment to give the engineering corps a book of standards of things used about the works, such as the lengths and diameters of bolts, all the dimensions of the cast and wrought iron washers, of all sorts of screws, pipe and fittings, shafting, etc., that were kept in stock. There should be included the different sizes and kinds of small tools, drills, taps, reamers, etc., in the toolroom; the capacity of the machines in the different departments, the sizes and shapes of bar steel, iron and plate in stock; the patterns on hand of gears, pillow blocks, etc., which could be used without the necessity of going over the whole stock of patterns, and any other general information that could be added from time to time.

I have come across several places where there was a partial attempt in this direction, but I have never seen it followed out to completion. If every one of the engineers and draftsmen about a plant had a book of blueprints which could be added to from time to time, it would more than pay for it-elf in a few months in the saving of time alone. Even one book to an office would be better than none.

Only a few days ago one of our highest-priced men wanted to know the diameter and thickness of a ¾-inch wrought-iron washer. He was in a position where it was necessary that he should have the sizes, and after spending some time in hunting for the desired information, he gave it up and started for the stock-house to measure one. On his way out he passed my desk and mentioned his troubles to me, and fortunately (or maybe unfortunately) a short time before I had received a catalog that had the sizes of wrought-iron washers in it, and gave them to him, which sizes he used rather than take the time to go out. Now, if the washers we have in stock are different there will possibly be trouble for Mr. Engineer later on. It is easy to see how a few minutes saved now and then will soon pay for the getting together of the information. Not long ago I wanted a common wood screw about ¼ inch diameter, and, according to general orders, I was compelled to order it by its number. No one in the office could tell me anything about the sizes of wood screws, or the diameter in inches for the number of the screw. Hence it was a case of a trip to the stock-house to find out what I wanted, and at a cost of fifteen minutes in time. Some time afterwards I found the desired information in a Brown & Sharpe catalog. No doubt there is a place to find all of these things, and that place in the office should be at hand for ready reference.

How many draftsmen know about the thickness of pattern lumber? But if they did, what a great saving there would be many times in the pattern shop. I have often seen drawings made, wherein the thickness of the metal of flat surfaces could just as well have been ⅞ as 1 inch, thereby saving time in dressing heavier stock down. How many know the number of fire or common brick to the cubic foot, or the weight for the same amount? and if they do, is it the same as where they were located last? Recently a letter was sent to our office from the chief, saying that fire brick would lay up 18½ to the cubic foot, and common brick 17. The figures used in another section of the country where I was located some time ago were fire brick 18 and common brick 22. In another place I was told that fire brick weighed 150 pounds per cubic foot; at yet a different locality, from actual experiment, the average weight per cubic foot of fire brick was 115 pounds. This is quite an item when you have to support a 42-inch pipe, several hundred feet long, lined with them.

Again, the sizes of timbers kept on hand are not known as a rule, and the draftsman goes ahead and uses something that is not kept in stock; whereas if he had a list he could just as well have used some other size. The result is lost time in changing drawings, or else the mill gang go ahead and use what they have on hand, and some day, unexpectedly, you run up against a snag.

It is extremely necessary for the draftsman to know the sizes of the small tools and the capacity of the machines to be able to design intelligently. About a year ago a large coupling was made for a 1,500-horse-power engine, and large turned bolts were used by the designer for bolting the flanges together. The drawing was finished and put into the shop, and the coupling was finished all but drilling the bolt holes. When they came to this it was found that there was no drill just the size, hence a delay of the drill press man and the machine until the drawing room could be consulted. Of course, the drill on hand was used and another loss in time came by changing the drawing to have a correct record.

These examples are very small things in themselves, but they serve to show how these petty trifles cause a loss of time, and, as a usual thing, high-priced time that could to a great extent be saved. This subject also brings to my mind several other things that should be at hand in every well regulated engineering department. There should be a library containing works of reference on engineering subjects, and all the leading mechanical magazines. I know of one concern which has a very large library of this kind, and it is a common thing to see someone looking up some point. The engineers and draftsmen can take the books and so forth out of the library to their homes or desks to study the subjects they have in hand. And it must pay, as the concern is a successful one.

I would go a step farther with the library and have as complete a set of up-to-date catalogs of all kinds on file as is possible to get. Much useful and necessary matter is contained in them, and in an office of any size there are several times each day when someone is asking if such and such is to be had.

There is no class of men who are expected to know so many different things as we of the engineering corps, and if book, papers, catalogs and standards will help us and pay handsome dividends on

the investment by the time saved, then why don't all the manufacturers give them to us and help themselves at the same time? G. J.

Cutting Square Threaded Screws.

Editor American Machinist:

I read with great interest the article on "Cutting Square-Threaded Screws," at page 1160. Will not some of the readers of the "American Machinist" who work in machine tool shops where such threads are constantly cut for large lead screws, give us their experience on the subject and the practice prevailing in their particular shops?

Could not a tool be made, with side cutting edges which are *radial straight lines*, and a curved front which would cut the correct shape and could be inserted, which the tool described in the latter part of the aforesaid article could not be? H.

The Close of the Pan American.

Near the end of every great exhibition someone is sure to take it into his head that the exhibition ought to be continued beyond the time originally set for its closing. He talks about it to others and this always leads to a report that the exhibition is to be continued beyond the date originally set. The next stage in the proceedings is that the matter gets before the Board of Control or Directors, or whatever it may be, and they consider the matter and always conclude to close the exhibition on the date originally decided upon, their reasons for doing this being generally that independently of whether it would be desirable to continue the exhibition or not, it is impossible to do it. The fact is that every exhibition is completely plastered over with contracts of every kind—with concessionnaires, with people who furnish supplies and with exhibitors, and there can never be a sufficient approach to unanimous or general extension of these contracts to make it possible to run an exhibition successfully beyond the period originally set for its closing. This experience has been repeated at Buffalo, ending with the action of the Board of Directors recently taken deciding that Saturday, November 2, at midnight, the exhibition will close.

Examination for Draftsman.

The United States Civil Service Commission, Washington, D. C., announces that on November 26-27, 1901, an examination will be held in any city in the United States where postal free delivery has been established, for the position of junior architectural draftsman. The examination will be upon arithmetic and elementary mathematics, knowledge of building materials and construction, free-hand drawing and orthographic projection, architectural drawing, and technical education and experience. From the eligibles resulting it is expected that certification will be made to one position at a salary of $1,000 and to three positions at $840 in the Supervising Architect's office, Treasury Department, and to other similar vacancies as they may occur. Persons who desire to compete should at once apply to the Commission for application forms 304 and 375, which should be executed and forwarded.

The "Bremen" Reconstructed.

It will be remembered that when the great fire took place among the Hoboken docks, opposite New York, in June of last year, the burning of the North German Lloyd steamer "Bremen" was perhaps the most tragic event of the conflagration. Not only was there a very great loss upon the steamer, but also a great loss of life as well. It was necessary to refit the ship, which at that time was only three years old, having been built by F. Schichau, in Dantzig, in 1897. It is noteworthy that in refitting the vessel it was thought desirable to considerably alter her, which has been done by lengthening her 25 feet, putting in larger boilers and new engines, such is the rapidity with which ideas regarding steamship construction now advance. The vessel recently arrived in New York on her first trip since the fire. The decorations and furnishings of the vessel are very beautiful and luxurious, and among other features there are nine rooms for one person only, for the accommodation of those voyagers who prefer not to make an ocean trip in the same room with three strangers; an experience which is not always quite pleasant. The "Bremen" is now 11,600 tons gross register. She has four double-ended and two single-ended boilers, carrying steam at 225 pounds pressure. In addition there is the equivalent of an additional boiler, which is a superheater. This resembles a coil boiler and is fired by furnaces. The steam passes through the coils and is superheated from 388 degrees Fahr. to 482 degrees Fahr. The superheater was not used on the trip coming over, as it is to be tested, and the company has decided to first ascertain the coal consumption without it and afterward when using it.

There are twin screws, 5,200 mm. (17 feet) diameter, 7,000 mm. (23 feet) pitch. The engines are four-cylinder quadruple expansion with four cranks, and cylinders 700 mm., 1,040 mm., 1,500 mm. and 2,120 mm. (27.5, 41, 59 and 83.4 inches) diameter, 1,350 mm. (53 inches) stroke. They are expected to develop about 8,200 horsepower; from which it will be seen that the "Bremen" is not intended for fast running, but rather to be comfortable.

Killed by a Planer.

Walter Edwards, twenty years old, a machinist in the employ of Bement, Miles & Co., Philadelphia, running a planer on night work, was almost instantly killed October 23 by being caught in the machine.

Better Wage Statistics for the Census.

One of the most satisfactory moves that has been made in connection with the census is the appointment by Director Merriam of Dr. Davis R. Dewey, professor of political economy and statistics in the Massachusetts Institute of Technology, to be an expert special agent of the census to prepare a report on wage statistics, to be used in connection with the census report of manufactures and the mechanical industries.

It is hoped that as a result of the work now being organized by Professor Dewey the Twelfth Census will be able to show the actual wages paid in the great manufacturing industries of the country in a manner and with a degree of accuracy that has never before been attempted in the census reports of this country.

All that it has ever been possible to obtain from any of our previous census reports, in so far as wages are concerned, has been a very unsatisfactory, misleading and uncertain "average earnings of employees," and this has been secured by dividing the total amount paid in wages by the total number of the employees reported. The quotient thus obtained has been accepted, but it has been in the absence of anything better, and it has always been with the knowledge that it has been a false quotient, for the reason that the divisor has not been the true number of employees to whom the total amount of wages has been paid.

It has not been reliable for purposes of comparison, for the further reason that at different censuses different methods have been employed for ascertaining the average number, and different phrascology has been used in framing the several schedules of inquiry.

It has therefore been an agreed fact by the statisticians who have been in the habit of using these figures that the "average earnings" have been worthless so far as being any indication of the actual wage rates prevailing in the several industries. To obtain the real facts regarding wages for the censuses of 1890 and 1900 half a dozen picked men have been sent into the field by the Census Office with instructions to copy the actual payrolls of typical and representative establishments in different industries and in different sections of the country. It is the analysis of these payrolls under Mr. Dewey's supervision which will enable the Census Office to show the actual rates of wages and show what the actual trend of wages has been as between 1890 and 1900, with a degree of precision and accuracy that has been heretofore impossible.

It is Director Merriam's determination to make the wage statistics of the Twelfth Census a reflection of the actual conditions prevailing in the various industries in 1900 Dr. Dewey was selected for this purpose for the reason that he has had such long

experience in the practical handling of statistics, and also for the high reputation which he earned during the time that he was engaged as chairman of the Massachusetts Commission of the Unemployed several years ago. A. F. TENNILLE.

[The Massachusetts State statistics of manufactures from which we publish abstracts yearly are commendable for their detailed and classified statements of wages in the leading industries. They are compiled by Horace G. Wadlin.—Ed.]

Judge Kohlsaat, of the United States Circuit Court, has somewhat modified an injunction order against the members of the International Association of Machinists in the Allis-Chalmers case. It will be remembered that a very sweeping injunction was granted in this case and it has now been modified so as to permit what is called moral suasion or peaceful efforts of the strikers to persuade others to refrain from work. Counsel for the men asked whether this would be interpreted to allow peaceful picketing and not receiving a satisfactory answer on this point the case was appealed to the United States Circuit Court of Appeals.

It is reported that a conference of railroad engineers in India is to be held at Calcutta in December to consider the adoption of a standard type of locomotive "such as exists in the United States." The object of this is stated to be to help British manufacturers and prevent future railroad contracts from different parts of the Indian Empire going to foreign firms.

Personal.

Lucius B. Sherman has been appointed Western manager of the "Railroad Gazette." His office is in the Monadnock Building, Chicago.

C. E. Prior, expert on tools of precision, for the past eighteen years with the Pratt & Whitney Company, resigned his position October 1.

J. F. Wilson has entered the firm of Wilson & McKay, cycle and tool makers, Dunedin, N. Z., Mr. McKay having withdrawn. The firm name is now Wilson & Wilson.

Mr. Sinclair, of Charles H. Besly & Co., Chicago, is starting on his second business trip around the world. He will visit France, Germany, Russia, India and Japan, returning via San Francisco.

W. H. Pike, Jr., who was formerly in St. Louis, but for nearly four years has been in Nottingham, England, has returned to this country and will probably reside in St. Louis permanently. Mr. Pike brings his wife with him, an English lady to whom he was married about a year ago.

Charles W. Barnaby, who has been connected with the Mongolia Mines Company and has been located near Urga, Mongolia, is returning to this country in November. Mr. Barnaby left New York in April, 1900, and spent some time in England, Scotland, Holland, Belgium, France, Germany, Russia and Siberia. He is completing the circuit of the Globe via the Desert of Gobi, China, Japan and the Philippines. He writes from Pekin that so far he has found no country to compare with his own.

Obituary.

Angus McLachlin died in Brooklyn, October 19, sixty-nine years old. Mr. McLachlin was born in Scotland and had lived in New York and Brooklyn since his twelfth year. He went to the Continental Iron Works in 1866 and had been for many years, and up to the time of his death, foreman of the shops at Greenpoint.

Henry O. Bradley, of Osgood Bradley & Sons, car builders, Worcester, Mass., died October 23, seventy-three years old. He was a son of the founder of the works, and since his father's death he with a brother had carried on the business. The firm began building railroad cars in 1842, the first built in the country, for the Boston & Worcester Railroad.

Herbert H. Herrington died October 13 at Macon, Ga., fifty-eight years old. He was with his father, who was the inventor of a repeating rifle, in the government small arms factory at Harper's Ferry before the Civil War, and during the war he was in the ordnance department of the Confederacy, after which he conducted a machine business in Macon.

Joseph E. Fales died at Worcester, Mass., October 21, in his ninety-first year. Mr. Fales was born in New London, Conn. He went to Worcester more than fifty years ago, and was a pioneer in the machine trade there. He was a member of the Rice, Barton & Fales Machine & Iron Company. His health had been excellent up to a week before his death.

Edward C. Lewis died at Waterbury, Conn., October 24, seventy-five years old. Mr. Lewis was born in Wales, but was brought to this country when five years old. In 1849 he was a foreman in the shops of the Waterbury Farrel Foundry & Machine Company, of which he later became president and principal owner. He was a stockholder in fifty-seven companies.

Inquiry for Machinery.

(162) Wanted, names and addresses of manufacturers of engraving or reducing machines which cut from models 10 or 12 inches down to any size in steel.

Manufacturers.

The Anchor Duck Mill, of Rome, Ga., will enlarge its plant.

The Wellsville (O.) plant of the American Sheet Steel Company is to be enlarged.

The Elkins (W. Va.) Brick & Tile Company is understood to be erecting a new plant.

A new foundry is to be built for the White Mountain Freezer Company, Nashua, N. H.

A factory building is to be erected for the Michigan Can Company, Ltd., Detroit, Mich.

The Paterson (N. J.) Savings Institution intends to erect a large mill building in the spring.

The James T. Powers Foundry Company, Elkton, Md., is putting up a modern building. 150x40 feet.

The Los Angeles (street) Railway Company, Los Angeles, Cal., has purchased land for new shops.

The Birmingham (Ala.) Powder Company has arranged for the erection of a $50,000 dynamite plant.

The Pipe Works Company, of Gadsden, Ala., has been organized with $50,000 capital, and is building a plant.

The Berlin Machine Works, Beloit, Wis., manufacturer of wood-working machinery, will enlarge its shops.

Swift & Co., Chicago, are about to prepare plans for the enlargement of their steam and refrigerating equipment.

Two blast furnaces are to be added to the East Helena, Mont., plant of the American Smelting & Refining Company.

Some repairs and building are being done on the grounds of the Aultman & Taylor plant on North Main street, Mansfield, O.

The Springfield (Ill.) Bridge & Iron Company has commenced the construction of a new manufacturing and office building.

The Johnston & Jennings Company, foundry and manufacturers of sash weights, Cleveland, O., will erect three new buildings.

The Fastener Manufacturing & Machine Company has secured factory property at Eleventh and Adams streets, Hoboken, N. J.

The Griffin Wheel Company has received a permit to erect a foundry at 262 to 272 North Sacramento avenue, Chicago; cost, $12,000.

The Narragansett Machine Company, Pawtucket, R. I., is receiving bids for the construction of a two-story addition, 160x40 feet.

The Bickford & Huffman Company, manufacturer of the "Favorite" grain drill at Macedon, N. Y., is looking for a new location.

The Robinson Manufacturing Company is building a new plant at Muncy, Pa. Machine and wood shops and a power-house are included.

The Texas State Penitentiary Board proposes to erect a sugar mill on its convict plantation in Brazoria County, to cost about $150,000.

The American Can Company, which recently absorbed the R. Tynes Smith Can Company, Baltimore, Md., will remodel the plant on Mill street.

The Fitzpatrick Glass Manufacturing Company, Falls Creek, Pa., is to erect a new plant for the manufacture of rough, ribbed and wire glass.

It is reported from Spokane, Wash., that James Breen will build a smelter on the east coast of Vancouver island, 40 miles north of Victoria, B. C.

Mr. Davis, of Van Wert, O., and Gilbert Barnes, of Paulding, O., have about completed arrangements for the erection of a machine shop in Paulding.

A proposition has been made by Henry D. Estabrook, of Chicago, representing a syndicate of capitalists, to locate a sugar cane plant at Fairbury, Neb.

The factory of the Sage Mattress & Spring Bed Company, New Orleans, La., of which P. J. Nevin is proprietor, has been burned, including some machinery.

The Milwaukee (Wis.) Electric Company,

manufacturer of dynamos and motors, has its power-house about completed and is ready for the iron for its machine shop.

It is reported from Susquehanna, Pa., that the Allen Paper Car Wheel Company, of Pullman, Ill., may soon remove its extensive plant to Westfall flats, Oakland side.

Smith & McCoy, Norfolk, Va., are building a machine and wood-working plant for repairing vessels. It is the intention to add the construction of tugs, schooners, etc.

The Columbia Bridge Company, of Pittsburgh, which has a plant at Carnegie, Pa., is contemplating the erection of a plant at Wheeling, W. Va., to cost a million.

The New York Kerosene Oil Engine Company, Third avenue and One Hundred and Thirtieth street, New York, has purchased land for a plant at College Point, N. Y.

It is proposed to organize a $20,000 stock company at Greenwood, S. C., for the erection of a cotton-batting mill, and Mayor T. B. Lee can probably give information about it.

The Auto Supply Company, 310 Mott avenue, New York, which manufactures automobile parts, engines and boilers, contemplates establishing a plant in South Milwaukee, Wis.

The J. W. Jenkins Company, of 200 North Water street, Rochester, N. Y., has broken ground for a shoe factory. A separate building will contain the lighting and power plant.

The Page Woven Wire Fence Company, Adrian, Mich., is not only contemplating increasing the capacity of its Monessen, Pa., plant, but is putting in new bloom and wire mills.

The Schroon River Pulp & Paper Company has been organized to succeed the Schroon River Pulp Company, Warrensburgh, N. Y., and besides enlarging the pulp mill, will build a paper mill.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant ; see p. 22.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Wanted—A Ballou lathe. Box 167, Am. M.

Gas engines. Northern Engin'r'g Works, Detroit, Mich.

Lathe attachment, saves time cutting threads. U. S. patent for sale. Box X X, A. M.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

See 12 presses & dies for sheet-metals, S. E. cor. Machinery Hall, Buffalo Exposition. Ferracute Mch. Co., Bridgeton, N. J.

Special tools, models, fine light mach'y and foundry work wanted. Murray Mfg. Co., Richmond Valley, Staten Island, N. Y.

Foundry for sale, making a specialty ; plenty of work ; size 75x50 ; or will sell half interest to a good man. Foundry, Elizabeth, N. J.

Wanted—One hydraulic press, about 40 tons ; new or good second-hand ; Vulcan or similar style for forcing shafts in rollers. Box 164, American Machinist.

For Sale—One Hanson & Van Winkle No. 1 225-watt dynamo, nearly new ; rheostat, two nickel-plating tanks, with all connecting rods. E. D. Luedders, Coldwater, Mich.

High-class machine design and drafting of all kinds done at reasonable rates by a responsible engineering firm ; ideas developed ; all business confidential. C. & N., care A. M.

To Be Sold—The wholesale manufacturing rights in North America of a very well introduced article of consumption. For particulars address E. 3847 Lz., care of Haasenstein & Vogler, Lucerne, Switzerland.

Purchaser for small manufacturing plant : lot, 100x180 feet ; machine shop, 32x68, two story, with line shaft and gasoline power ; foundry, 40x54, new modern equipment ; good location ; for sale cheap. Hart-Parr Co., Madison, Wis.

A prominent typewriter manufacturing company have just opened a department for the manufacture and sale of novelties. Responsible parties having something of this class to turn out will oblige by addressing "Work," care American Machinist.

Party with medium size, modern, up-to-date machine shop equipment, that can and will remove to another locality, can learn of an unusually good opportunity to form valuable associations by addressing, with details, "Permanent Business," care Amer. Machinist.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-5b Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded ; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Wood pattern maker wants steady job. Box 172, American Machinist.

Experienced mechanical draftsman is looking for position near city. Box 137, Am. M.

Toolroom foreman, first class, modern practice, wishes position. Box 170, Am. Mach.

Experienced cost clerk ; capable in cotton mill or machine work. Box 160, Am. Mach.

Draftsman, graduate, with several years' experience, wants position. Box 169, Am. M.

Expert designer of fine machinery and special tools open for engagement. Box 165, American Machinist.

Mechanical engineer and machine designer desires change ; technical man with 8 years' practical experience. Box 136, Am. Mach.

Who wants a superintendent that knows his business? Minimum salary, $2,000 a year ; correspondence confidential. Box 166, American Machinist.

An expert designer and builder of printing machinery is open to accept a responsible position, where ability and ingenuity are required. Box 161, American Machinist.

A new engagement is desired by man now with large advertising agency, qualified in modern advertising methods ; have also had experience as salesman for large corporation. P. O. Box 132, Evanston, Ill.

Master mechanic, up to date, 16 years' experience of all kinds, electrical and mechanical works, tools, dies, etc., small and heavy work, desires position. Address Ge. Drew, General Delivery, Chicago, Ill.

Position as superintendent or general foreman ; am conversant with the machine business in all its branches, a designer of tools, jigs and modern appliances for economical production. Box 163, American Machinist.

Bookkeeper, age 30, single ; thoroughly experienced in manufacturing line ; up-to-date methods ; all-around man ; capable of taking charge of office ; exceptional references ; salary required, $20 per week. Box 162, Am. M.

Position as superintendent or general foreman, by practical mechanic, up to date in modern methods, organizing and the handling of men to obtain best results, duplication of parts, shop management ; best references furnished. Address Box 171, Amer. Machinist.

Superintendent, at present in charge of large concern, will be open for engagement December 1 ; familiar with cost-reducing methods of large modern manufacturing plants, also contracting shops ; good estimater and designer ; both practical and technical engineer. Address Box 168, Amer. Machinist.

Position wanted by a mechanical engineer, 20 years' wide experience, good executive ability, now in a responsible position with large firm who manufacture machinery and tools, and produce work from same upon the interchangeable system ; have first-class cost-account system ; is open for a position as mechanical engineer, superintendent or manager ; the best of reasons for desiring a change ; might invest in a growing concern. Box 159, American Machinist.

Help Wanted.

Working foreman for erecting floor of electrical factory. "Alternator," care Am. M.

Wanted—First-class machinists on engine work ; no labor trouble. Address Reeves Machine Co., Trenton, N. J.

Wanted—Draftsman ; one experienced in elevator construction preferred. Address Box 152, American Machinist.

Draftsman wanted ; first class on electrical machinery ; state age, experience and salary wanted. Box 150, American Machinist.

Wanted—Foundry foreman, executive ability and experience with general line machinery castings. Address H. M., care Am. M.

Wanted—Metal patternmakers ; state experience and wages expected ; good position for right man. Box 154, Amer. Machinist.

We are starting a new plant and invite application from first-class wood pattern makers and machinists. Address De Laval Steam Turbine Co., Trenton, N. J.

Good patternmakers, both wood and metal, desiring steady employment, will find it to their advantage to apply to the General Electric Co., Schenectady, N. Y.

Wanted—First-class machinist for 10 ft. boring mill ; also toolmakers and lathe hands ; good wages ; steady work. Apply Michigan Brass & Iron Works, Detroit, Mich.

Wanted—First-class mechanical draftsman to go to the country ; applicants must state salary expected, nature of previous experience, age and reference. Box 143, Am. M.

We invite applications from machinists and molders ; give references, experience and wages expected ; work on air compressors. Franklin Air Compressor Co., Franklin, Pa.

Wanted—Mechanical draftsman in office of large corporation ; one thoroughly experienced in presses and sheet-metal tools ; give reference and salary expected. Box 133, Am. M.

Wanted—A draftsman experienced in detail drawing and tool designing, capable of taking charge of office employing about 30 men. Address, with particulars, Box 156, Am. Mach.

Wanted—Mechanical draftsman ; one experienced in power transmission preferred ; give reference, age and salary expected ; permanent position for right man. Box 157, American Machinist.

Wanted—Experienced toolmakers on fine jigs and dies ; location, central Pennsylvania ; steady work ; good pay for good men. Address, giving age and experience, Box 158, American Machinist.

A technical graduate, well up in steam engineering, familiar with modern shop practice, cost-keeping and management of men. Address, stating age, experience, salary, etc., Box 151, American Machinist.

Wanted—Two machinists ; one to operate Niles floor boring machine, and one for 6 ft. Niles boring mill ; experienced men only ; wages $3.50 and $3.25 per day. Address Abner Doble Co., San Francisco, Cal.

Foundry foreman wanted ; one who is competent to take charge of a new shop located near New York, fitted with all improvements to do the heaviest class of work. Address "Marine," care American Machinist.

Wanted—Machinists, first-class toolmakers, vise hands, planer and boring mill hands on heavy work, wood and metal patternmakers. Apply C. C. Tyler, Superintendent, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Mechanical superintendent wanted, familiar with the manufacture of firearms on a large scale, possessing executive and mechanical ability. Address, stating age, experience and references, A., Box 2123, General Post Office, New York.

We are enlarging our works, and will shortly require an increased number of skilled mechanics ; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—A draftsman experienced in designing pump and compressor work, who is also well up in best methods of gas engine design and construction. Address, giving references, age and salary expected, "Venango," care American Machinist.

Shop superintendent, capable of handling the manufacturing end of a concern employing upwards of 400 men on gas and steam engines, stand pipes and heavy plate work ; modern and well-equipped shop. Address Box 153, American Machinist.

Mechanical draftsman wanted ; experienced on general machinery, designing, estimating and machine shop practice, especially on steam engines and pumps. Address, stating

The Moore-Whitmore Company, manufacturer of baskets, South Milwaukee, Wis., will make improvements in the way of additional buildings and machinery estimated to cost $15,000.

The Philadelphia Gear Works, on account of the growth of their business, have removed to the corner of Seventh and Cherry streets, where they have a more central and convenient location on the level of the street.

The directors of the Crucible Steel Company of America at Pittsburgh have been discussing plans for a new plant at Clairton. It would be one of the finest in the United States, and would cost about $5,000,000.

The Pope Tinplate Company, of which C. E. Pope, of Pittsburgh, Pa., is the promoter, has let the contracts for the buildings of the new plant to be located at Steubenville, O., to the Riter-Conley Manufacturing Company.

The Beaver Falls (Pa.) Fuel & Manufacturing Company, makers of drills and mining tools, have more orders than they can conveniently handle. The first of the year they will erect additions and put in more forges.

The new shops of the John Thompson & Sons Manufacturing Company, manufacturer of agricultural implements and gas engines, Beloit, Wis., are taking on shape and will be ready for the machinery during the winter.

S. A. Treat is completing plans for an eight-story manufacturing block which Edgar A. White, of W. D. De Wolf & Co., real estate operators, contemplates erecting at 189 to 193 Jefferson street, Chicago. Excavation has begun.

A large force of men employed in the Central Railroad of New Jersey shops at Elizabethport, N. J., has been moved to Ashley, Pa., owing to the Elizabethport shops burning down. The shops at Ashley will be enlarged.

The National Can Company has been organized by Theodore D. Buhl, William W. Warren, D. M. Ireland, Frank W. Eddy, Frederic T. Ducharme, F. E. Wadsworth and E. H. Nelson, and will erect a plant in Detroit, Mich.

An open-hearth building is to be erected at Burnham, Pa., for the Standard Steel Works, of Philadelphia. The plans, drawn by the Wellman-Seaver Engineering Company, of Cleveland, show a three-story structure, 124x 195 feet.

The Los Andes Rubber, Lumber & Fruit Company, of Guatemala and New Orleans, has been incorporated under the laws of Louisiana. The idea is to handle rubber on a large scale, and to work up the product at New Orleans.

A building at Minneapolis, Minn., has been purchased jointly by two concerns of that city, the Gregg-Seager Company, hardware, and Wm. C. Gregg & Co., sugar plantation specialties. They will fit it up for manufacturing purposes.

Spokane Falls & Northern Railroad car repairs will be made at Northport, Wash., as soon as new shops are completed. Buildings are to be erected this fall and provision is made for the construction of new cars, as well as the usual repair work.

A movement is now under way for the construction of a large plant in New Castle, Pa., for the manufacture of nuts, bolts and finishings for structural iron work. W. J. Whieldon, a Mercer attorney, is preparing to make application for a charter.

The Livingston Sugar Company, consisting of P. H. Gilke, of Kalamazoo, Mich.; L. C. Cole, of Toledo, O.; J. R. Hankey, of Bowling Green, O.; Judge Cole, of Fowlerville, Mich., and others, has made a proposition to locate a beet sugar factory at Fowlerville.

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experience, references and compensation, "Confidential," Box 173, AMERICAN MACHINIST.

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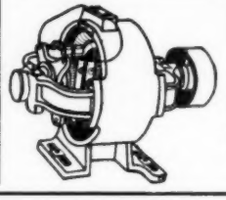

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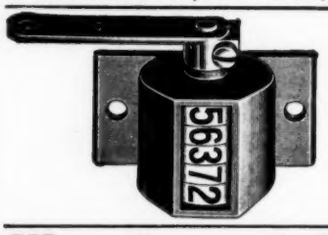

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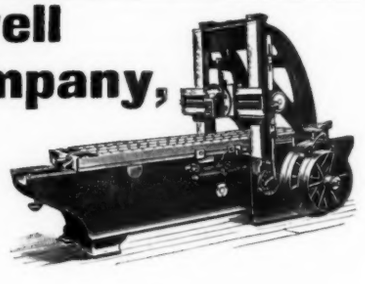

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